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Aerodynamic Influence Coefficients from Slender-Body Theory: Analytical Development and Computational Procedure

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Prepared for COMMANDER SPACE SYSTEMS DIVISION
UNITED STATES AIR FORCE
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ABSTRACT

A method is reviewed for computing the aerodynamic influence coefficients (AICs) for slender bodies. The method is based on the unsteady slender-body theory by Miles and its extension to obtain the AICs by Rodden and Revell.

The simplicity of the slender-body theory permits the definition of a number of sets of AICs for use in transient analysis. The influence coefficients relating the transient aerodynamic forces to the body deflections and their first two derivatives are defined by the following relation:

$$\{F(t)\} = (qS/\bar{c})\left([C_{hs}]\{h\} + [C_{hd}]\{\dot{h}\bar{c}/V\} + [C_{hi}]\{\ddot{h}\bar{c}^2/V^2\}\right) \quad .$$

The matrices $[C_{hs}]$, $[C_{hd}]$, and $[C_{hi}]$ are seen to be steady, damping, and inertial AICs, respectively. The oscillatory AICs are defined by

$$\{F\} = \rho\omega^2 b_r^2 s[C_h]\{h\}$$

and are related to the above definitions through

$$2k_r^2(\bar{c}s/S)[C_h] = [C_{hs}] + ik_r(\bar{c}/b_r)[C_{hd}] - k_r^2(\bar{c}/b_r)^2[C_{hi}] \quad .$$

The Aerospace IBM 7090 Computer Program No. HM15 provides the AICs in printed and optional punched-card output formats. The program capacity is 50 control points and, in the oscillatory case, 50 values of reduced velocity.

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FIGURES

SYMBOLS

b_r	Reference semichord
C_h	Element of oscillatory AIC matrix
C_{hd}	Element of damping AIC matrix
C_{hi}	Element of inertial AIC matrix
C_{hs}	Element of steady AIC matrix
$\bar{c}$	Reference chord
F	Control point force
h	Control point deflection
I	Momentum of cross-flow virtual mass
k_r	Reference reduced frequency, $k_r = \omega b_r/V$
q	Free stream dynamic pressure
R	Body radius in finned region
S	Reference area
S(x)	Body cross-sectional area
$S_{n-1/2}$, $S_{n+1/2}$	Cross-sectional area of aft and forward ends, respectively, of n'th body segment
s	Reference semispan
t	Time
V	Free stream velocity
w	Downwash
x, y, z	Cartesian coordinates
Δ_n	Length of n'th body segment

SYMBOLS (Continued)

ΔV_n	Volume of n'th body segment
ρ	Free stream density
ω	Circular frequency
$[\ ]$	Square matrix
$\left\| \ \right\|$	Column matrix

SECTION I
FORMULATION OF PROBLEM

A. Introduction

The simplest theory available for the estimation of unsteady aerodynamic loads on slender bodies is the momentum theory of Munk[1] as extended to the unsteady case by Miles.[2,3] The limitations of the so-called slender-body theory have also been summarized by Miles (Ref. 4, Table 2, p. 161). These are: (1) the fineness ratio must be much less than unity; (2) the Mach number must be much less than the reciprocal of the fineness ratio; and (3) the motion must be slowly varying, or, more specifically, in the oscillatory case the reduced frequency must be of order unity. Hence, we see that the slender-body theory can be useful in the supersonic flight regime provided that the body is sufficiently slender and the motion is not violent.

The present formulation is based on the derivation of the oscillatory aerodynamic influence coefficients (AICs) from slender-body theory given by Rodden and Revell.[5] The simplicity of slender-body theory permits the extension of Ref. 5 to obtain a number of sets of AICs for use in transient analysis, and this extension is made in the present treatment.

B. Sign Convention

The standard NASA stability axis system is used throughout. The positive directions of x, y, and z are forward, starboard, and downward, respectively. Positive rotations are given by applying the right-hand rule to the coordinate directions. The vehicle is assumed to be moving in the positive x-direction; i. e., the relative wind is in the negative x-direction. The force sign convention is the same as the coordinate convention.

C. Derivation of Equations

The derivation of equations for the oscillatory case is given in Ref. 5 (pp. 60-72). However, Ref. 5 contains a mistake in sign that leads to the incorrect sign on the damping terms, so it becomes necessary to repeat the

derivation here with the correction. We shall present the derivation for the oscillatory case since, by properly identifying the various terms, we may indicate the results for the transient case. We define the transient influence coefficients to relate the aerodynamic forces to the body deflections and their first two derivatives by the following

$$\{F(t)\} = (qS/\bar{c})\left([C_{hs}]\{h\} + [C_{hd}]\{\dot{h}\bar{c}/V\} + [C_{hi}]\{\ddot{h}\bar{c}^2/V^2\}\right) \quad . \tag{1}$$

The matrices $[C_{hs}]$, $[C_{hd}]$, and $[C_{hi}]$ are seen to be steady, damping, and inertial AICs, respectively. The oscillatory AICs are defined by

$$\{F\} = \rho\omega^2 b_r^2 s[C_h]\{h\} \quad . \tag{2}$$

Equations (1) and (2) must be identical in the oscillatory case, so the following relationship must exist among the various AICs

$$2k_r^2(\bar{c}s/S)[C_h] = [C_{hs}] + ik_r(\bar{c}/b_r)[C_{hd}] - k_r^2(\bar{c}/b_r)^2[C_{hi}] \quad . \tag{3}$$

The equations given by Bisplinghoff, Ashley, and Halfman[6] provide a convenient basis for deriving the AICs of a slender body. The vertical force acting per unit length of the body is the reaction to the substantial rate of change of the momentum of the virtual mass per unit length of the body

$$\frac{dF}{dx} = -\frac{D}{Dt}\left(\frac{dI}{dx}\right) \tag{4}$$

where the substantial derivative operator is given by

$$\frac{D}{Dt} = -V\frac{\partial}{\partial x} + \frac{\partial}{\partial t} \tag{5}$$

since the relative wind is moving in the negative x-direction (see Fig. 1).

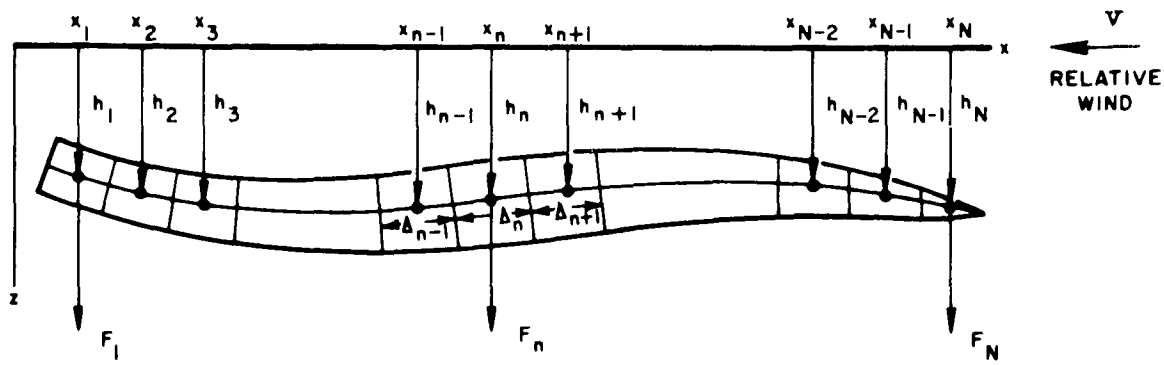

Fig. 1. Slender-body geometry for AICs.

The momentum of the virtual mass per unit length is found from the local cross-sectional area and the downwash

$$\frac{dI}{dx} = \rho S(x) w(x, t) \tag{6}$$

where the downwash is the substantial derivation of the deflection

$$w(x, t) = \frac{Dh}{Dt} \tag{7a}$$

$$= -V \frac{\partial h}{\partial t} + \frac{\partial h}{\partial t} \quad . \tag{7b}$$

If we assume harmonic motion and substitute Eqs. (5), (6), and (7b) into Eq. (4), we obtain

$$\frac{dF}{dx} = \rho V \frac{d}{dx}\left[S(x)\left(-V \frac{dh}{dx} + i\omega h\right)\right] - i\omega\rho S(x)\left(-V \frac{dh}{dx} + i\omega h\right) \quad . \tag{8}$$

To obtain the force on a specified length of the body, it is necessary to integrate Eq. (8) over that length. We consider the body to be divided into a

number of sections, not necessarily of equal length, as shown in Fig. 1. For the n'th section, the control point is taken at the midpoint of its length Δ_n.* The aft end of the section is located at $x_{n-1/2} = x_n - \Delta_n/2$ and has the cross-section area $S_{n-1/2}$; the forward end of the section is located at $x_{n+1/2} = x_n + \Delta_n/2$ and has the cross-section area $S_{n+1/2}$. Carrying out the integration of Eq. (8) for the n'th section yields the following

$$F_n = \int_{x_{n-1/2}}^{x_{n+1/2}} \frac{dF}{dx}\, dx \tag{9a}$$

$$= \rho V \left[S(x) \left(-V\frac{dh}{dx} + i\omega h \right) \right]_{x_{n-1/2}}^{x_{n+1/2}} - i\omega\rho \int_{x_{n-1/2}}^{x_{n+1/2}} S(x) \left(-V\frac{dh}{dx} + i\omega h \right) dx \tag{9b}$$

$$= \rho V \left[-V(S_{n+1/2}\, h'_{n+1/2} - S_{n-1/2}\, h'_{n-1/2}) + i\omega(S_{n+1/2}\, h_{n+1/2} - S_{n-1/2}\, h_{n-1/2}) \right]$$

$$- i\omega\rho \int_{x_{n-1/2}}^{x_{n+1/2}} S(x)(-Vh' + i\omega h)\, dx \quad . \tag{9c}$$

We resort to Lagrangian interpolation for the evaluation of the terms in Eq. (9c). For the first two terms, we choose parabolic interpolation

$$h = h_{n-1} \frac{(x - x_n)(x - x_{n+1})}{(x_{n-1} - x_n)(x_{n-1} - x_{n+1})} + h_n \frac{(x - x_{n-1})(x - x_{n+1})}{(x_n - x_{n-1})(x_n - x_{n+1})}$$

$$+ h_{n+1} \frac{(x - x_{n-1})(x - x_n)}{(x_{n+1} - x_{n-1})(x_{n+1} - x_n)} \quad . \tag{10}$$

*The input to the program must be the coordinates of the endpoints (aft and forward) of each section, from which the control point locations are calculated by averaging. With a given total body length, it is not possible to specify the control point locations a priori.

For evaluation of the integral, we use only linear interpolation

$$h = h_n + h'_n(x - x_n) \tag{11}$$

and

$$S(x) = (1/\Delta_n)\left[S_{n-1/2}(x_{n+1/2} - x) + S_{n+1/2}(x - x_{n-1/2})\right] \quad . \tag{12}$$

The three-point interpolation leads to three elements in each row of the AIC matrix. Therefore, from the definition of Eq. (2),

$$F_n = \rho\omega^2 b_r^2 s(C_{hn,n-1}h_{n-1} + C_{hn,n}h_n + C_{hn,n+1}h_{n+1}) \quad . \tag{13}$$

By identifying Eq. (13) and Eq. (9c), after evaluating the integral of Eq. (9c) by means of Eqs. (11) and (12), we obtain the following relation for the AICs

$$C_{hn,n-1}h_{n-1} + C_{hn,n}h_n + C_{hn,n+1}h_{n+1} = \left(1/k_r^2 s\right)\Big[(S_{n-1/2}h'_{n-1/2} - S_{n+1/2}h'_{n+1/2})$$

$$+ i(k_r/b_r)(S_{n+1/2}h_{n+1/2} - S_{n-1/2}h_{n-1/2} + h'_n\Delta V_n)$$

$$- \left(k_r^2/b_r^2\right)\left[\left(\Delta_n^2/12\right)(S_{n-1/2} - S_{n+1/2})h'_n - h_n\Delta V_n\right]\Big] \quad , \tag{14}$$

where ΔV_n is the volume of the n'th section.

If we evaluate the deflections in Eq. (10) at stations $x_{n-1/2}$ and $x_{n+1/2}$, and then, by differentiating Eq. (10), evaluate the slopes at stations $x_{n-1/2}$, x_n, $x_{n+1/2}$, then we may place the right-hand side of Eq. (14) in terms of the control point deflections h_{n-1}, h_n, and h_{n+1}. If we carry out this substitution,

the AICs are found by identifying the coefficients of the control point deflections on both sides of Eq. (14). The following results are obtained

$$C_{hn,n-1} = \left(1/k_r^2 sD_{n-1}\right)\Big[2S_{n+1/2}(\Delta_{n+1} - \Delta_n) - 2S_{n-1/2}(3\Delta_n + \Delta_{n+1}) + i(k_r/b_r)$$
$$\times \left[-S_{n+1/2}\Delta_n\Delta_{n+1} - S_{n-1/2}\Delta_n(2\Delta_n + \Delta_{n+1}) - 2\Delta V_n(\Delta_n + \Delta_{n+1})\right]$$
$$- \left(k_r^2/b_r^2\right)\left(\Delta_n^2/6\right)(S_{n+1/2} - S_{n-1/2})(\Delta_n + \Delta_{n+1})\Big] \quad , \tag{15}$$

where

$$D_{n-1} = (\Delta_{n-1} + \Delta_n)(\Delta_{n-1} + 2\Delta_n + \Delta_{n+1}) \quad ; \tag{16}$$

$$C_{hn,n} = \left(1/k_r^2 sD_n\right)\Big[2S_{n+1/2}(\Delta_{n-1} + 2\Delta_n - \Delta_{n+1}) - 2S_{n-1/2}(\Delta_{n-1} - 2\Delta_n - \Delta_{n+1})$$
$$+ i(k_r/b_r)\Big[S_{n+1/2}\Delta_{n+1}(\Delta_{n-1} + 2\Delta_n) - S_{n-1/2}\Delta_{n-1}(2\Delta_n + \Delta_{n+1})$$
$$+ 2\Delta V_n(\Delta_{n+1} - \Delta_{n-1})\Big] - \left(k_r^2/b_r^2\right)\Big[\left(\Delta_n^2/6\right)(S_{n-1/2} - S_{n+1/2})(\Delta_{n+1} - \Delta_{n-1}) - D_n\Delta V_n\Big]\Big], \tag{17}$$

where

$$D_n = (\Delta_{n-1} + \Delta_n)(\Delta_n + \Delta_{n+1}) \quad ; \tag{18}$$

$$C_{hn,n+1} = \left(1/k_r^2 sD_{n+1}\right)\Big[2S_{n-1/2}(\Delta_{n-1} - \Delta_n) - 2S_{n+1/2}(\Delta_{n-1} + 3\Delta_n) + i(k_r/b_r)$$
$$\times \left[S_{n+1/2}\Delta_n(\Delta_{n-1} + 2\Delta_n) + S_{n-1/2}\Delta_{n-1}\Delta_n + 2\Delta V_n(\Delta_{n-1} + \Delta_n)\right]$$
$$- \left(k_r^2/b_r^2\right)\left(\Delta_n^2/6\right)(S_{n-1/2} - S_{n+1/2})(\Delta_{n-1} + \Delta_n)\Big] \quad , \tag{19}$$

where

$$D_{n+1} = (\Delta_{n-1} + 2\Delta_n + \Delta_{n+1})(\Delta_n + \Delta_{n+1}) \quad . \tag{20}$$

The above expressions are applicable for all intermediate sections of the body, sections which are centrally located as far as the interpolation and differentiation are concerned. The exceptions are the first and N'th sections. The counterpart of Eq. (14) for the first section is

$$C_{h1,1}h_1 + C_{h1,2}h_2 + C_{h1,3}h_3 = \left(1/k_r^2 s\right)\left\{S_{1/2}h'_{1/2} - S_{3/2}h'_{3/2} + i(k_r/b_r)\right.$$

$$\left.\times (S_{3/2}h_{3/2} - S_{1/2}h_{1/2} + h'_1\Delta V_1) - \left(k_r^2/b_r^2\right)\left[\left(\Delta_1^2/12\right)(S_{1/2} - S_{3/2})h'_1 - h_1\Delta V_1\right]\right\} . \tag{21}$$

Carrying out the evaluation of the appropriate deflections and slopes from Eq. (10) in terms of the first three control point deflections leads to the following coefficients for the first row of the AIC matrix

$$C_{h1,1} = \left(1/k_r^2 s D_1\right)\left\{2S_{3/2}(3\Delta_2 + \Delta_3) - 2S_{1/2}(4\Delta_1 + 3\Delta_2 + \Delta_3) + i(k_r/b_r)\right.$$

$$\times \left[S_{3/2}\Delta_2(2\Delta_2 + \Delta_3) - S_{1/2}(2\Delta_1 + \Delta_2)(2\Delta_1 + 2\Delta_2 + \Delta_3) - 2\Delta V_1(2\Delta_1 + 3\Delta_2 + \Delta_3)\right]$$

$$\left. - \left(k_r^2/b_r^2\right)\left[\left(\Delta_1^2/6\right)(S_{3/2} - S_{1/2})(2\Delta_1 + 3\Delta_2 + \Delta_3) - D_1\Delta V_1\right]\right\} , \tag{22}$$

where

$$D_1 = D_{n-1} \text{ with } n = 2 \quad ;$$

$$C_{h1,2} = \left(1/k_r^2 sD_2\right)\Big|2S_{3/2}(\Delta_1 - 2\Delta_2 - \Delta_3) + 2S_{1/2}(3\Delta_1 + 2\Delta_2 + \Delta_3) + i(k_r/b_r)$$

$$\times \left[S_{3/2}\Delta_1(2\Delta_2 + \Delta_3) + S_{1/2}\Delta_1(2\Delta_1 + 2\Delta_2 + \Delta_3) + 2\Delta V_1(\Delta_1 + 2\Delta_2 + \Delta_3)\right]$$

$$- \left(k_r^2/b_r^2\right)\left(\Delta_1^2/6\right)(S_{1/2} - S_{3/2})(\Delta_1 + 2\Delta_2 + \Delta_3)\Big| \quad , \tag{23}$$

where

$$D_2 = D_n \text{ with } n = 2 \quad ;$$

$$C_{h1,3} = \left(1/k_r^2 sD_3\right)\Big|2S_{3/2}(\Delta_2 - \Delta_1) - 2S_{1/2}(3\Delta_1 + \Delta_2) + i(k_r/b_r)\Big[-S_{3/2}\Delta_1\Delta_2$$

$$- S_{1/2}\Delta_1(2\Delta_1 + \Delta_2) - 2\Delta V_1(\Delta_1 + \Delta_2)\Big] - \left(k_r^2/b_r^2\right)\left(\Delta_1^2/6\right)(S_{3/2} - S_{1/2})(\Delta_1 + \Delta_2)\Big| \, , \tag{24}$$

where

$$D_3 = D_{n+1} \text{ with } n = 2 \quad .$$

Similarly, the counterpart of Eq. (14) for the N'th section is

$$C_{hN,N-2}\,h_{N-2} + C_{hN,N-1}\,h_{N-1} + C_{hN,N}\,h_N = \left(1/k_r^2 s\right)\Big|S_{N-1/2}\,h'_{N-1/2}$$

$$- S_{N+1/2}\,h'_{N+1/2} + i(k_r/b_r)(S_{N+1/2}\,h_{N+1/2} - S_{N-1/2}\,h_{N-1/2} + h'_N\Delta V_N)$$

$$- \left(k_r^2/b_r^2\right)\Big[\left(\Delta_N^2/12\right)(S_{N-1/2} - S_{N+1/2})\,h'_N - h_N\Delta V_N\Big]\Big| \quad , \tag{25}$$

and we obtain the following coefficients for the last (N'th) row of the AIC matrix

$$C_{hN,N-2} = \left(1/k_r^2 sD_{N-2}\right)\Big|2S_{N-1/2}(\Delta_{N-1} - \Delta_N) - 2S_{N+1/2}(3\Delta_N + \Delta_{N-1})$$

$$+ i(k_r/b_r)\left[S_{N+1/2}\,\Delta_N(2\Delta_N + \Delta_{N-1}) + S_{N-1/2}\,\Delta_N\,\Delta_{N-1} + 2\Delta V_N(\Delta_N + \Delta_{N-1})\right]$$

$$- \left(k_r^2/b_r^2\right)\left(\Delta_N^2/6\right)(S_{N-1/2} - S_{N+1/2})(\Delta_N + \Delta_{N-1})\Big| \quad , \tag{26}$$

where

$$D_{N-2} = D_{n-1} \text{ with } n = N - 1 \quad ;$$

$$C_{hN,N-1} = \left(1/k_r^2 sD_{N-1}\right)\Big|2S_{N+1/2}(3\Delta_N + 2\Delta_{N-1} + \Delta_{N-2}) + 2S_{N-1/2}(\Delta_N - 2\Delta_{N-1} - \Delta_{N-2})$$

$$+ i(k_r/b_r)\Big[-S_{N+1/2}\,\Delta_N\,(2\Delta_N + 2\Delta_{N-1} + \Delta_{N-2}) - S_{n-1/2}\,\Delta_N(2\Delta_{N-1} + \Delta_{N-2})$$

$$- 2\Delta V_N(\Delta_N + 2\Delta_{N-1} + \Delta_{N-2})\Big] - \left(k_r^2/b_r^2\right)\left(\Delta_N^2/6\right)(S_{N+1/2} - S_{N-1/2})(\Delta_N + 2\Delta_{N-1} + \Delta_{N-2})\Big| \tag{27}$$

where

$$D_{N-1} = D_n \text{ with } n = N - 1 \quad ;$$

$$C_{hN,N} = \left(1/k_r^2 sD_N\right)\Big|2S_{N-1/2}(3\Delta_{N-1} + \Delta_{N-2}) - 2S_{N+1/2}(4\Delta_N + 3\Delta_{N-1} + \Delta_{N-2})$$

$$+ i(k_r/b_r)\Big[S_{N+1/2}(2\Delta_N + \Delta_{N-1})(2\Delta_N + 2\Delta_{N-1} + \Delta_{N-2}) - S_{N-1/2}\,\Delta_{N-1}(2\Delta_{N-1} + \Delta_{N-2})$$

$$+ 2\Delta V_N(2\Delta_N + 3\Delta_{N-1} + \Delta_{N-2})\Big] - \left(k_r^2/b_r^2\right)\Big[\left(\Delta_N^2/6\right)(S_{N-1/2} - S_{N+1/2})$$

$$\times(2\Delta_N + 3\Delta_{N-1} + \Delta_{N-2}) - D_N\,\Delta V_N\Big]\Big| \quad , \tag{28}$$

where

$$D_N = D_{n+1} \text{ with } n = N - 1 \quad .$$

To illustrate the assembly of the coefficients into the AIC matrix, we show the format below for a slender body having five degrees of freedom.

$$[C_h] = \begin{bmatrix} C_{h1,1} & C_{h1,2} & C_{h1,3} & 0 & 0 \\ C_{h2,1} & C_{h2,2} & C_{h2,3} & 0 & 0 \\ 0 & C_{h3,2} & C_{h3,3} & C_{h3,4} & 0 \\ 0 & 0 & C_{h4,3} & C_{h4,4} & C_{h4,5} \\ 0 & 0 & C_{h5,3} & C_{h5,4} & C_{h5,5} \end{bmatrix} \tag{29}$$

If we formally write each element of the oscillatory AIC matrix in the form

$$C_{h_{ij}} = \left(1/k_r^2 s D_j\right)\left[A_{ij} + i(k_r/b_r) B_{ij} - \left(k_r^2/b_r^2\right) C_{ij}\right] \quad , \tag{30}$$

then the elements of the transient AIC matrices may be identified by comparison with Eq. (3). We see that the elements of the steady AIC matrix are given by

$$C_{hs_{ij}} = 2(\bar{c}/S) A_{ij}/D_j \quad , \tag{31}$$

the elements of the damping AIC matrix are given by

$$C_{hd_{ij}} = (2/S) B_{ij}/D_j \quad , \tag{32}$$

and, finally, the elements of the inertial AIC matrix are given by

$$C_{hi_{ij}} = (2/\bar{c}S)\, C_{ij}/D_j \quad . \tag{33}$$

Before concluding this discussion, we note that, according to Miles (Ref 4, p. 169) the slender-body theory presented above may be applied to finned vehicles if an effective cross-section area in the finned region, whose geometry is shown in Fig. 2, is taken as

$$S_e = \pi(s^2 - R^2 + R^4/s^2) \quad . \tag{34}$$

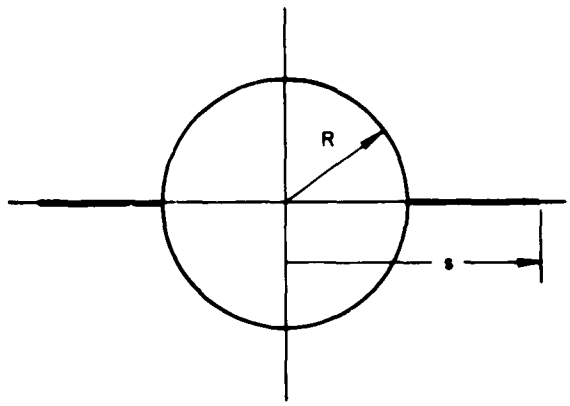

Fig. 2. Cross section of finned region of slender body.

D. References

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SECTION II
GENERAL DESCRIPTION OF INPUT

A. Units

Since all dimensional input is geometrical and the aerodynamic matrix is dimensionless, only a consistent set of length units is necessary: inches or feet.

B. Classes of Numerical Data and Limitations

The data required by the program are control indicators, geometry, and a set of reduced velocities. The example problem illustrates their use.

1. Example Problem

We consider the five-segment body shown in Fig. 3 computing the oscillatory case for the reduced velocities ($1/k_r$) of 2.0 and 6.0, the transient case (steady, damping, and inertial AICs), and the steady case (steady AICs only).

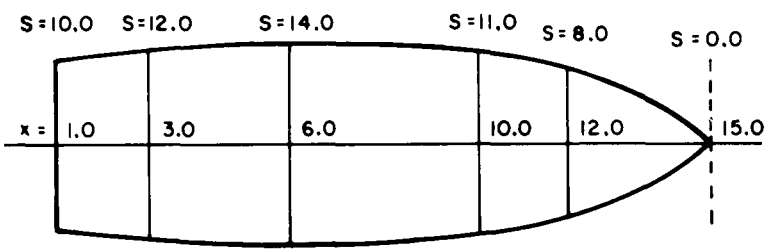


Fig. 3. Five-segment body.

The geometrical data required as input to the program are listed below.

Segment No.	x (ft)	S (sq ft)
1 (aft)	1	10
1 (forward), 2 (aft)	3	12
2 (forward), 3 (aft)	6	14
3 (forward), 4 (aft)	10	11
4 (forward), 5 (aft)	12	8
5 (forward)	15	0

$\bar{c}$ = 10.0 ft

b_r = 5.0 ft

s = 20.0 ft

S = 200.0 sq ft

2. Program Restrictions and Options

a. The maximum number of segments into which a body may be subdivided must be $\leq$ 50.

b. The maximum number of $1/k_r$'s for one data deck must be $\leq$ 50.

c. If it is desired to compute the steady case, a zero value of $1/k_r$ must be used, to compute the transient case a negative value of $1/k_r$ must be used.

SECTION III
DATA DECK SETUP

A. Loading Order

Input data decks punched from keypunch forms are loaded behind column binary deck HM15. Any number of complete decks may be stacked. The data for each deck must be in the following order:

(1) Heading card

(2) IX, KVBRW, IPUNCH

(3) CBAR, BR, S, SREF

(4) X(I) series

(5) LOCAL AREA(I) series

(6) $(1/k_r)_j$ series

B. Input Data Description

(1) The heading card may contain any information desired in Columns 2 through 72. Column 1 is always left blank.

(2) Control card (FORMAT 18I4)

(a) IX = the number of control points; also the number of body segments, ≤ 50

(b) KVBRW = the number of reduced velocities to be listed in data item (6), ≤ 50

(c) IPUNCH = 0 or blank if the computed matrices are to be punched in cards;

$\neq 0$ if no punched output is desired.

(3) Single parameters card (FORMAT 6E12.8)

(a) CBAR = $\bar{c}$, reference chord

(b) BR = b_r, reference semichord

(c) S = s, reference semispan

(d) SREF = S, reference area

The constants are tabulated in the order in which they are defined. CBAR and SREF are used in the steady and transient cases; BR and S (semispan) are necessary for computing oscillatory cases. When only one pair of the constants is needed, the two respective card fields for the other pair may contain zero or be left blank.

(4) X(I) Segment coordinate series, $I \leq 51$ (FORMAT 6E12.8)

The x coordinates ($x_{n-1/2}$ and $x_{n+1/2}$) used in this series locate the aft and forward end of each body segment. The number of terms in the series is one more than the number of control points (I = 1, IX + 1). Begin the series with $x_{n-1/2}$ (aft end) of the aft body segment and list the consecutive coordinates through $x_{n+1/2}$ (forward end) of the foremost body segment (nose).

(5) LOCAL AREA (I) series (FORMAT 6E12.8)

These are the local cross-section areas ($S_{n-1/2}$ and $S_{n+1/2}$) at the aft and forward end of each body segment. The number of terms in this series is the same as in X(I). The areas are listed in the same order as the coordinates; begin with $S_{n-1/2}$ for the aft body segment and list the consecutive areas through $S_{n+1/2}$ for the foremost body segment.

(6) $(1/k_r)_j$ series (FORMAT 6E12.8)

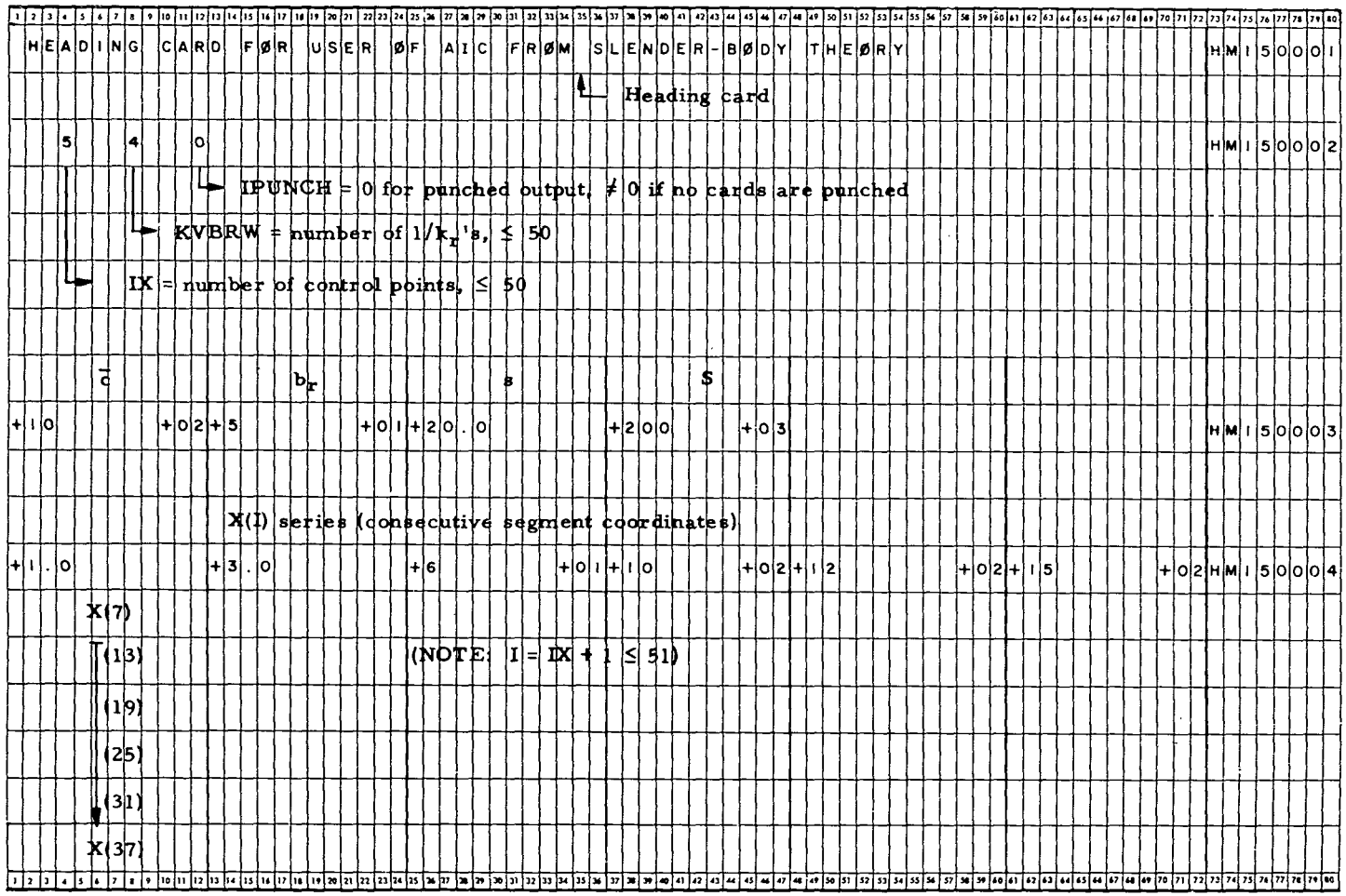
This series consists of the reference reduced velocities for the oscillatory case and the codes for obtaining the steady and transient cases. To obtain the steady matrix $[C_{hs}]$ input $1/k_r = 0.0$ and for the

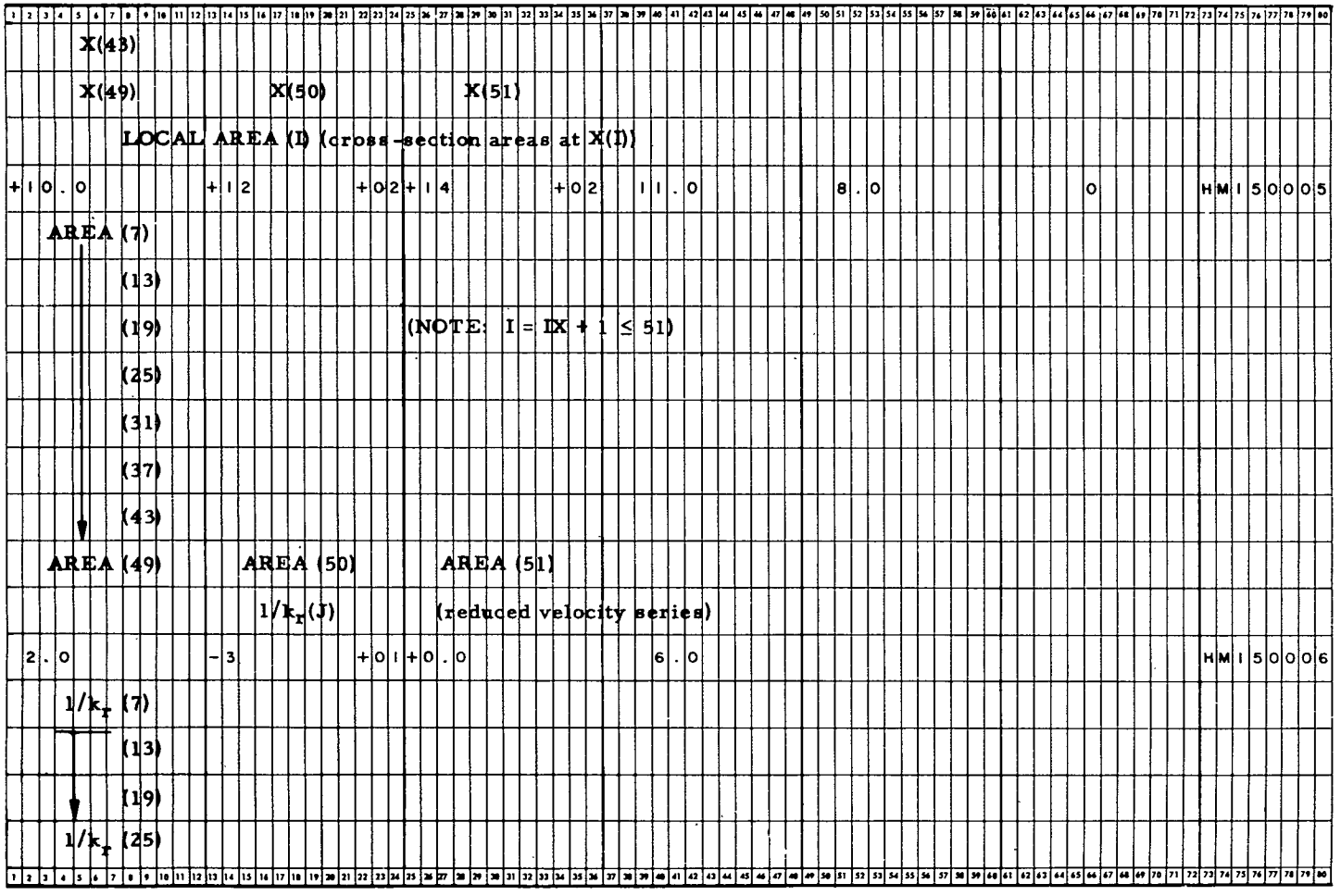
transient case ($[C_{hs}]$, $[C_{hd}]$, and $[C_{hi}]$) use $1/k_r$ = any negative number. The number of $1/k_r$'s in the series is set by KVBRW in the control card.

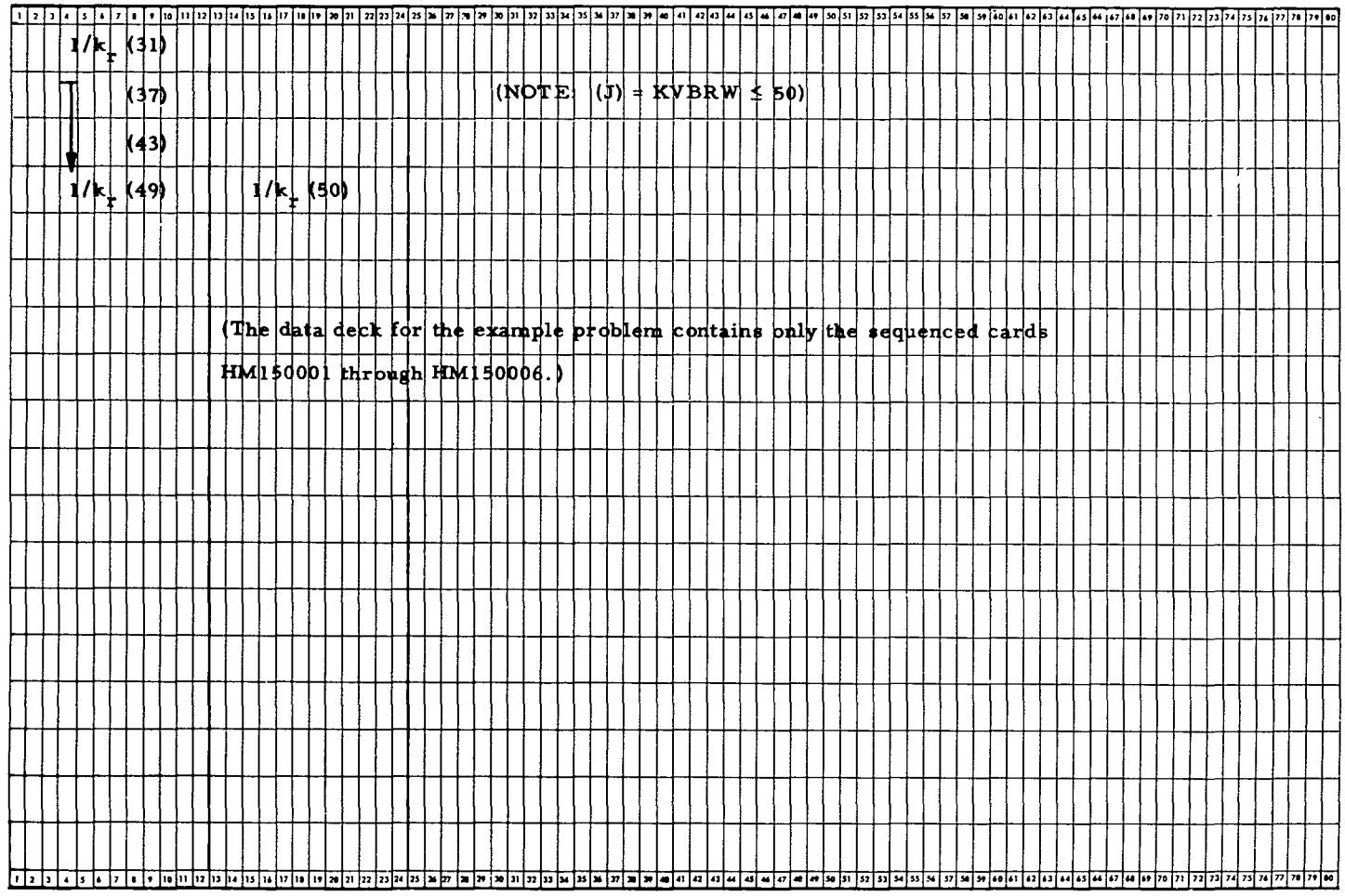
NOTE: Each new series starts on a new line (card).

C. Example Keypunch Forms

Example keypunch forms are given on the following pages. Columns 73 through 80 are reserved for data deck identification. This space may be used in any fashion; however, it is suggested that the last three columns be used for sequencing. In the example that follows, only the sequenced cards (lines) are to be used in the sample data deck; the lines with blank Columns 73 through 80 are for explanation of the input.


HEADING CARD FØR USER ØF AIC FRØM SLENDER-BØDY THEØRY HMI50001
Heading card
5 4 0 HMI50002
IPUNCH = 0 for punched output, ≠ 0 if no cards are punched
KVBRW = number of 1/k_T's, ≤ 50
IX = number of control points, ≤ 50
IC b_T s $
+10 +02+5 +01+20.0 +200 +03 HMI50003
X(I) series (consecutive segment coordinates)
+1.0 +3.0 +6 +011+10 +02+12 +02+15 +02 HMI50004
X(7)
(13)
(NOTE: I = IX + 1 ≤ 51)
(19)
(25)
(31)
X(37)


X(43)
X(49)
X(50)
X(51)
LOCAL AREA (I) (cross-section areas at X(I))
+10.0 +12 +02+14 +02 11.0 8.0 0 HM150005
AREA (7)
(13)
(19)
(25)
(31)
(37)
(43)
(NOTE: I = IX + 1 ≤ 51)
AREA (49)
AREA (50)
AREA (51)
1/k_r(J)
(reduced velocity series)
2.0 -3 +01+0.0 6.0 HM150006
1/k_r (7)
(13)
(19)
1/k_r (25)


1/k_r (31)
(37)
(43)
1/k_r (49)
1/k_r (50)
(NOTE: (J) = KVBRW ≤ 50)
(The data deck for the example problem contains only the sequenced cards
HM150001 through HM150006.)

SECTION IV
PROGRAM OUTPUT

A. Printed Output

1. All input data.

2. The segment lengths [DELTA X (I)] and the control point coordinates XN (I), (Δ_n and x_n in Section I.C).

3. Each AIC matrix preceded by the associated $1/k_r$ and the matrix size.

4. Sequencing number of the first and last punched cards (output) for each AIC matrix.

5. Example problem printed output is given on the following pages.

HEADING CARD FOR USER OF AIC FROM SLENDER-BODY THEORY

AERODYNAMIC INFLUENCE COEFFICIENTS FROM SLENDER-BODY THEORY

INPUT DATA

5 SECTIONS
4 REDUCED VELOCITIES

CBAR= 0.09999999E 02
BR= 0.49999999E 01
S= 0.20000000E 02
SREF= 0.20000000E 03

X(I)	LOCAL AREA
0.09999999E 01	0.09999999E 02
0.30000000E 01	0.12000000E 02
0.59999999E 01	0.13999999E 02
0.09999999E 02	0.11000000E 02
0.12000000E 02	0.80000000E 01
0.15000000E 02	0.

OUTPUT DATA

CONTROL PT. NO.	DELTAX(I)	CONTROL POINT XN(I)
1	0.20000000E 01	0.20000000E 01
2	0.30000000E 01	0.45000000E 01
3	0.40000000E 01	0.80000000E 01
4	0.20000000E 01	0.11000000E 02
5	0.30000000E 01	0.13500000E 02

AERODYNAMIC INFLUENCE COEFFICIENTS FROM SLENDER-BODY THEORY

1./KR= 0.20000000E 01

NUMBER OF CONTROL POINTS= 5

THE OSCILLATORY CASE

	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6
1	-0.31675555E-00	-0.45599999E-00	0.73234285E 00	0.59885713E 00	-0.37158729E-00	-0.10285714E-00
2	-0.94736665E 00	-0.35799999E-00	0.18154857E 01	0.20800000E-00	-0.79011904E 00	0.19000000E-00
3	0.	0.	-0.95718679E 00	-0.27428570E-00	0.19765714E 01	-0.13238095E-00
4	0.	0.	0.	0.	-0.55121211E 00	-0.11878788E-00
5	0.	0.	0.	0.	-0.50303029E-01	0.50909089E-01

	COLUMN 7	COLUMN 8	COLUMN 9	COLUMN 10	COLUMN
1	0.	0.	0.	0.	
2	0.	0.	0.	0.	
3	-0.91938459E 00	0.34666666E-00	0.	0.	
4	0.10114666E 01	-0.10266666E-00	-0.42225453E-00	0.16145454E-00	
5	-0.52453332E 00	-0.30399999E-00	0.59883635E 00	0.93090907E-01	

PUNCHED CARDS NOS. HM15 1 THRU HM15 13

AERODYNAMIC INFLUENCE COEFFICIENTS FROM SLENDER-BODY THEORY

1./KR=-0.30000000E 01

NUMBER OF CONTROL POINTS = 5

THE TRANSIENT CASE

THE CHS MATRIX

	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN
1	-0.17999999E-00	0.36571427E-00	-0.18571428E-00	0.	0.	
2	-0.47333332E-00	0.86857141E 00	-0.39523809E-00	0.	0.	
3	0.	-0.47912087E-00	0.93809521E 00	-0.45897435E-00	0.	
4	0.	0.	-0.27575757E-00	0.48666665E-00	-0.21090908E-00	
5	0.	0.	-0.24242423E-01	-0.26666666E-00	0.29090908E-00	

THE CHD MATRIX

	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN
1	-0.22799999E-00	0.29942856E-00	-0.51428570E-01	0.	0.	
2	-0.17899999E-00	0.10399999E-00	0.94999999E-01	0.	0.	
3	0.	-0.13714285E-00	-0.66190474E-01	0.17333332E-00	0.	
4	0.	0.	-0.59393939E-01	-0.51333332E-01	0.80727270E-01	
5	0.	0.	0.25454544E-01	-0.15200000E-00	0.46545453E-01	

THE CHI MATRIX

	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN
1	-0.21622221E-01	-0.45714284E-03	0.79365077E-04	0.	0.	
2	0.34999999E-03	-0.39171427E-01	-0.17857142E-03	0.	0.	
3	0.	-0.52747252E-03	-0.50190474E-01	0.71794869E-03	0.	
4	0.	0.	-0.15151514E-03	-0.19066665E-01	0.21818181E-03	
5	0.	0.	0.90909089E-03	-0.43999999E-02	-0.85090906E-02	

PUNCHED CARDS NOS. HM15 14 THRU HM15 33

AERODYNAMIC INFLUENCE COEFFICIENTS FROM SLENDER-BODY THEORY

1./KR= 0.

NUMBER OF CONTROL POINTS = 5

THE STEADY CASE

	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN
1	-0.17999999E-00	0.36571427E-00	-0.18571428E-00	0.	0.	
2	-0.47333332E-00	0.86857141E 00	-0.39523809E-00	0.	0.	
3	0.	-0.47012087E-00	0.93809521E 00	-0.45897435E-00	0.	
4	0.	0.	-0.27575757E-00	0.48666665E-00	-0.21090908E-00	
5	0.	0.	-0.24242423E-01	-0.26666666E-00	0.29090908E-00	

PUNCHED CARDS NOS. HM15 34 THRU HM15 41

AERODYNAMIC INFLUENCE COEFFICIENTS FROM SLENDER-BODY THEORY

1./KR= 0.59999999E 01

NUMBER OF CONTROL POINTS= 5

THE OSCILLATORY CASE

	REAL COLUMN 1	IMAGINARY COLUMN 2	REAL COLUMN 3	IMAGINARY COLUMN 4	REAL COLUMN 5	IMAGINARY COLUMN 6
1	-0.31967555E 01	-0.13679999E 01	0.65837713E 01	0.17965714E 01	-0.33430158E 01	-0.30857142E-00
2	-0.85206998E 01	-0.10739999E 01	0.15712628E 02	0.62399999E 00	-0.71139284E 01	0.56999999E 00
3	0.	0.	-0.86231206E 01	-0.82285713E 00	0.16986094E 02	-0.39714285E-00
4	0.	0.	0.	0.	-0.49633332E 01	-0.35636363E-00
5	0.	0.	0.	0.	-0.43818181E-00	0.15272727E-00

	COLUMN 7	COLUMN 8	COLUMN 9	COLUMN 10	COLUMN
1	0.	0.	0.	0.	
2	0.	0.	0.	0.	
3	-0.82629741E 01	0.10399999E 01	0.	0.	
4	0.87981331E 01	-0.30799999E-00	-0.37967999E 01	0.48436362E-00	
5	-0.47911999E 01	-0.91199999E 00	0.52533817E 01	0.27927272E-00	

PUNCHED CARDS NOS. HM15 42 THRU HM15 54

B. Punched Output

1. A deck of punched cards (output) from this program is suitable as an input deck to other programs requiring AICs.

2. All punched output is sequenced in order on Columns 73 through 80 starting with HM150001. The data is punched in the following order:

a. Card 1 contains $(1/k_r)$: (FORMAT 6E12.8).

b. Card 2 contains IX, the size (number of control points) of the AIC matrix (FORMAT 18I4).

c. The AIC matrix punched in column binary form and its TRA card make up the remainder of the punched output for $(1/k_r)$.

3. The order of Statement 2 can be repeated for all reduced velocities per input deck if we note that in the transient case, the three matrices $[C_{hs}]$, $[C_{hd}]$, and $[C_{hi}]$, which must be considered in Statement 2.c, are punched in the order listed with a TRA card after each matrix.

4. Each AIC matrix is punched by columns. Column 1 starts in Orgin 1 and Column 2 in Location (1 + matrix size).

5. The oscillatory matrices are punched in the order Column 1 (real), Column 1 (imaginary); Column 2 (real), Column 2 (imaginary); . . . ; Column IX (real), Column IX (imaginary). In the steady, damping, and inertial matrices all columns are real and are punched in order.

SECTION V
PROCESSING INFORMATION

A. Operation

STANDARD FORTRAN MONITOR system

B. Estimated Machine Time

T = time in minutes

IX = number of control points

KVBRW = number of reduced velocities per deck

m = number of decks of input data

$$T = 0.5 + 0.01 \sum_{j=1}^{m} (IX)_j \, (KVBRW)_j$$

C. Machine Components Used

A number of core storages

Standard FORTRAN input tape (N1)

Standard FORTRAN output print tape (N2)

Standard FORTRAN output punch tape (N3)

SECTION VI
PROGRAM NOTES

A. Subroutines Used

BINPU: binary punch routine

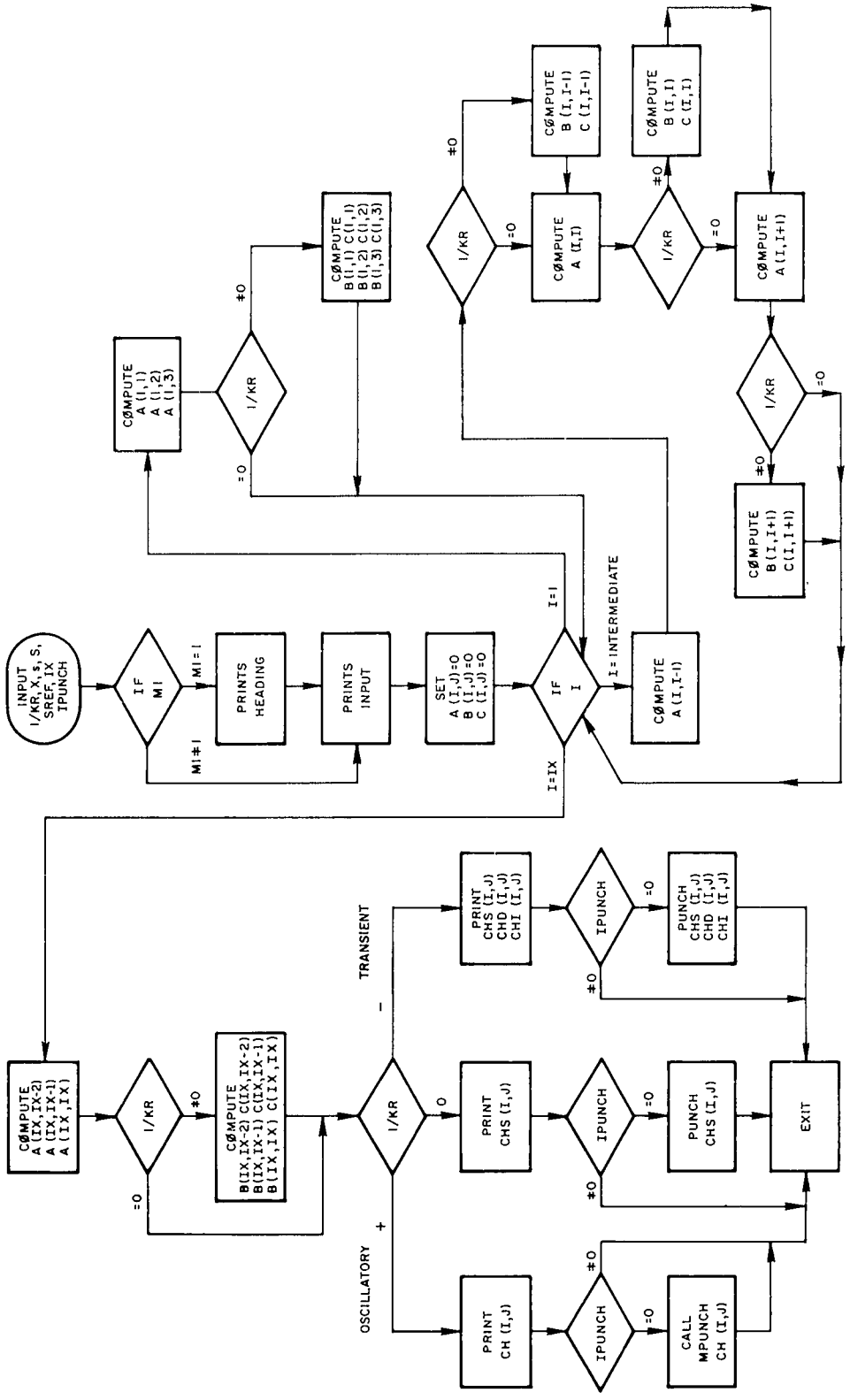
MPUNCH: punch AIC matrix

MPRINT: prints AIC matrix

B. Generalized Tapes

Input, print, and punch tapes are defined as Units 2, 3, and 5, respectively; however, these may be altered by placing the desired units on symbolic cards HM150007, HM150008, and HM150009.

SECTION VII
FLOW DIAGRAM



SECTION VIII
SYMBOLIC LISTING

Some of the symbols used in the program are defined as follows:

FORTRAN symbols	Definition
A (I, J).	$[C_{hs}]$, also the associated working array
B (I, J)	$[C_{hd}]$, also the associated working array
BR	b_r
CBAR	$\bar{c}$
C (I, J)	$[C_{hi}]$, also the associated working array
CH (I, J), CH (I, J + 1)	Respective real and imaginary parts of the oscillatory AIC Matrix
DFI, DF2, . . . , DF9	D_1, D_2, D_3, D_{N-2}, D_{N-1}, D_N, D_{n-1}, D_n, and D_{n+1}, respectively
DELTAX (I)	Δ_n for segment i, i = n
DELVOL (I)	ΔV_n for segment i, i = n
IX	Number of control points
S	s
LOCAL AREA (I)	Used in printed output only, see SVAR (below)
SREF	S
SVAR (I)	$S_{n-1/2}$ for segment i (i = 1, IX) and $S_{n+1/2}$ for segment IX
SVMINU (I)	$S_{n-1/2}$ for segment i
KVBRW	Number of reduced velocities included in the data deck

FORTRAN symbols	Definition
X (I)	$x_{n-1/2}$ for segment i (i = 1, IX) and $x_{n+1/2}$ for segment IX
XKR (J)	$1/k_r$ for reduced velocity j, j = 1, KVBRW
XN (I)	Control point coordinate, segment i
XMINUS (I)	$X_{n-1/2}$ for segment i
XPLUS (I)	$X_{n+1/2}$ for segment i

The complete symbolic listing is given on the following pages.

```
      DIMENSION SVAR(51),SVPLUS(50),SVMINU(50),X(51),XN(50),              HM150001
     1DELVOL(50),DELTAX(50),XPLUS(50),XMINUS(50),A(50,50),B(50,50),       HM150002
     2CH(50,50),C(50,50),TITLE(12),XKR(50)                                HM150003
C     DEFINE N1 TAPE TO BE READ INPUT TAPE NUMBER                         HM150004
C     DEFINE N2 TAPE TO BE WRITE OUTPUT TAPE NUMBER                       HM150005
C     DEFINE N3 TAPE TO BE PUNCH TAPE NUMBER                              HM150006
 2    N1=2                                                                HM150007
      N2=3                                                                HM150008
      N3=5                                                                HM150009
      M1=1                                                                HM150010
      READ INPUT TAPE N1,1,(TITLE(I),I=1,12)                              HM150011
 1    FORMAT(12A6)                                                        HM150012
      READ INPUT TAPE N1,3,IX,KVBRW,IPUNCH                                HM150013
 3    FORMAT(18I4)                                                        HM150014
      IX1=IX+1                                                            HM150015
      READ INPUT TAPE N1,40,CBAR,BR,S,SREF,                               HM150016
     1(X(I),I=1,IX1)                                                      HM150017
 40   FORMAT(4E12.8/(6E12.8))                                             HM150018
      READ INPUT TAPE N1,41,(SVAR(I),I=1,IX1)                             HM150019
 41   FORMAT(6E12.8)                                                      HM150020
      READ INPUT TAPE N1,131,(XKR(L),L=1,KVBRW)                           HM150021
 131  FORMAT(6E12.8)                                                      HM150022
      REWIND N3                                                           HM150023
      DO 21 I=1,IX                                                        HM150024
      N=I+1                                                               HM150025
      XPLUS(I)=X(N)                                                       HM150026
      XMINUS(I)=X(I)                                                      HM150027
      DELTAX(I)=XPLUS(I)-XMINUS(I)                                        HM150028
      XN(I)=(XPLUS(I)+XMINUS(I))/2.                                       HM150029
      SVPLUS(I)=SVAR(N)                                                   HM150030
      SVMINU(I)=SVAR(I)                                                   HM150031
      DELVOL(I)=(SVPLUS(I)+SVMINU(I))/2.*DELTAX(I)                        HM150032
 21   CONTINUE                                                            HM150033
      J1=0                                                                HM150034
      IF(M1-1)109,109,112                                                 HM150035
 109  WRITE OUTPUT TAPE N2,501,(TITLE(I),I=1,12)                          HM150036
 501  FORMAT(1H1 31X,12A6 //)                                             HM150037
```

```
      WRITE OUTPUT TAPE N2,813                                          HM150038
813   FORMAT(1H 29X,35H AERODYNAMIC INFLUENCE COEFFICIENTS              HM150039
     1  25H FROM SLENDER-BODY THEORY//)                                 HM150040
814   FORMAT(1H1 29X,35H AERODYNAMIC INFLUENCE COEFFICIENTS             HM150041
     1  25H FROM SLENDER-BODY THEORY//)                                 HM150042
      WRITE OUTPUT TAPE N2,4,IX,KVBRW,CBAR,BR,S,SREF                    HM150043
4     FORMAT(1H 49X,11H INPUT DATA//47X,1I4,9H SECTIONS/                HM150044
     1  47X,1I4,19H REDUCED VELOCITIES//49X,6H CBAR=1E15.8              HM150045
     2  /51X,4H BR=1E15.8/52X,3H S=1E15.8/49X,6H SREF=1E15.8//)         HM150046
      WRITE OUTPUT TAPE N2,115,(X(I),SVAR(I),I=1,IX1)                   HM150047
115   FORMAT(1H 39X,5H X(I),24X,12H  LOCAL AREA//                       HM150048
     1    (35X,1E15.8,18X,1E15.8))                                     HM150049
      WRITE OUTPUT TAPE N2,140                                          HM150050
140   FORMAT( // 52X,12H OUTPUT DATA //)                                HM150051
      WRITE OUTPUT TAPE N2,45,((I,DELTAX(I),XN(I)),                     HM150052
     1I=1,IX)                                                           HM150053
45    FORMAT(1H 17X, 16H CONTROL PT. NO. 17X,10H DELTAX(I)              HM150054
     1  14X,20H CONTROL POINT XN(I),//(23X,1I4,22X,                     HM150055
     2  1E15.8,13X,1E15.8))                                             HM150056
112   J2=1                                                              HM150057
      DO 22 I=1,IX                                                      HM150058
      DO 22 J=1,IX                                                      HM150059
      A(I,J)=0.                                                         HM150060
      B(I,J)=0.                                                         HM150061
      C(I,J)=0.                                                         HM150062
22    CONTINUE                                                          HM150063
      M1=2                                                              HM150064
      DO 999 L=1,KVBRW                                                  HM150065
      COEFA=XKR(L)**2/S                                                 HM150066
      KS=IX**2                                                          HM150067
      DO 100 I=1,IX                                                     HM150068
      M=I-1                                                             HM150069
      N=I+1                                                             HM150070
      IF(I-1)6,5,6                                                      HM150071
5     DF1=(DELTAX(1)+DELTAX(2))*(DELTAX(1)+2.*DELTAX(2)+DELTAX(3))      HM150072
      DF2=(DELTAX(1)+DELTAX(2))*(DELTAX(2)+DELTAX(3))                   HM150073
      DF3=(DELTAX(1)+2.*DELTAX(2)+DELTAX(3))*(DELTAX(2)+DELTAX(3))      HM150074
      A(1,1)=(2.*SVPLUS(1)*(3.*DELTAX(2)+DELTAX(3))-                    HM150075
```

```
     12.*SVMINU(1)*(4.*DELTAX(1)+3.*DELTAX(2)+DELTAX(3)))/DF1                HM150076
      A(1,2)=(2.*SVPLUS(1)*(DELTAX(1)-2.*DELTAX(2)-DELTAX(3))                HM150077
     1+2.*SVMINU(1)*(3.*DELTAX(1)+2.*DELTAX(2)+DELTAX(3)))/DF2               HM150078
      A(1,3)=(-2.*SVPLUS(1)*(DELTAX(1)-DELTAX(2))-2.*                        HM150079
     1SVMINU(1)*(3.*DELTAX(1)+DELTAX(2)))/DF3                                HM150080
      IF(XKR(L))25,100,25                                                    HM150081
25    B(1,1)=(SVPLUS(1)*DELTAX(2)*(2.*DELTAX(2)+                             HM150082
     1DELTAX(3))-SVMINU(1)*(2.*DELTAX(1)+DELTAX(2))*(2.*                     HM150083
     2DELTAX(1)+2.*DELTAX(2)+DELTAX(3))-2.*DELVOL(1)*(2.*DELTAX(1)           HM150084
     3+3.*DELTAX(2)+DELTAX(3)))/DF1                                          HM150085
      B(1,2)=(SVPLUS(1)*DELTAX(1)*(2.*DELTAX(2)+DELTAX(3))                   HM150086
     1+SVMINU(1)*DELTAX(1)*(2.*DELTAX(1)+2.*DELTAX(2)+DELTAX(3))            HM150087
     2+2.*DELVOL(1)*(DELTAX(1)+2.*DELTAX(2)+DELTAX(3)))/DF2                 HM150088
      B(1,3)=-1./DF3*(SVPLUS(1)*DELTAX(1)*DELTAX(2)+SVMINU(1)                HM150089
     1*DELTAX(1)*(2.*DELTAX(1)+DELTAX(2))+2.*DELVOL(1)*(DELTAX(1)           HM150090
     2+DELTAX(2)))                                                          HM150091
      C(1,1)=1./DF1*(DF1*DELVOL(1)-DELTAX(1)**2/6.(SVPLUS(1)-                HM150092
     1SVMINU(1))*(2.*DELTAX(1)+3.*DELTAX(2)+DELTAX(3)))*(-1.)               HM150093
      C(1,2)=-1./DF2*(DELTAX(1)**2/6.*(SVPLUS(1)-SVMINU(1))*                 HM150094
     1(DELTAX(1)+2.*DELTAX(2)+DELTAX(3)))                                    HM150095
      C(1,3)=+1./DF3*(DELTAX(1)**2/6.*(SVPLUS(1)-SVMINU(1))*                 HM150096
     1(DELTAX(1)+DELTAX(2)))                                                 HM150097
      GO TO 100                                                              HM150098
6     IF(I-IX)7,8,8                                                          HM150099
7     DO 97 J=1,IX                                                           HM150100
      IF (J-M)97,9,10                                                        HM150101
9     DF7=(DELTAX(M)+DELTAX(I))*(DELTAX(M)+2.*DELTAX(I)+DELTAX(N))           HM150102
      A(I,J)=1./DF7*(-2.*SVPLUS(I)*(DELTAX(I)-DELTAX(N))                     HM150103
     1-2.*SVMINU(I)*(3.*DELTAX(I)+DELTAX(N)))                                HM150104
      IF(XKR(L))30,97,30                                                     HM150105
30    B(I,J)=-1./DF7*(SVPLUS(I)*DELTAX(I)*DELTAX(N)+SVMINU(I)*               HM150106
     1DELTAX(I)*(2.*DELTAX(I)+DELTAX(N))+2.*DELVOL(I)*(DELTAX(I)            HM150107
     2+DELTAX(N)))                                                          HM150108
      C(I,J)=+1./DF7*(DELTAX(I)**2/6.*(SVPLUS(I)-                            HM150109
     1SVMINU(I))*(DELTAX(I)+DELTAX(N)))                                      HM150110
      GO TO 97                                                               HM150111
10    IF(J-(M+1))11,11,12                                                    HM150112
11    DF8=(DELTAX(M)+DELTAX(I))*(DELTAX(I)+DELTAX(N))                        HM150113
```

```
      A(I,J)=1./DF8*(2.*SVPLUS(I)*(DELTAX(M)+2.*DELTAX(I)                HM150114
     1-DELTAX(N))-2.*SVMINU(I)*(DELTAX(M)-2.*DELTAX(I)-DELTAX(N)))       HM150115
      IF(XKR(L))31,97,31                                                 HM150116
31    B(I,J)=1./DF8*(SVPLUS(I)*DELTAX(N)*(DELTAX(M)+2.*                  HM150117
     1DELTAX(I))-SVMINU(I)*DELTAX(M)*(2.*DELTAX(I)+DELTAX(N))            HM150118
     2+2.*DELVOL(I)*(DELTAX(N)-DELTAX(M)))                               HM150119
      C(I,J)=1./DF8*(DF8*DELVOL(I)+DELTAX(I)**2/6.*                      HM150120
     1(SVPLUS(I)-SVMINU(I))*(DELTAX(N)-DELTAX(M)))*(-1.)                 HM150121
      GO TO 97                                                           HM150122
12    IF (J-(M+2))13,13,100                                              HM150123
13    DF9=(DELTAX(M)+2.*DELTAX(I)+DELTAX(N))*(DELTAX(I)+DELTAX(N))       HM150124
      A(I,J)=1./DF9*(-2.*SVPLUS(I)*(DELTAX(M)+3.*DELTAX(I))+             HM150125
     12.*SVMINU(I)*(DELTAX(M)-DELTAX(I)))                                HM150126
      IF(XKR(L))14,97,14                                                 HM150127
14    B(I,J)=1./DF9*(SVPLUS(I)*DELTAX(I)*(DELTAX(M)+2.*                  HM150128
     1DELTAX(I))+SVMINU(I)*DELTAX(M)*DELTAX(I)+2.*DELVOL(I)*             HM150129
     2(DELTAX(M)+DELTAX(I)))                                             HM150130
      C(I,J)=1./DF9*(DELTAX(I)**2/6.*(SVPLUS(I)-SVMINU(I))               HM150131
     1*(DELTAX(M)+DELTAX(I)))*(-1.)                                      HM150132
97    CONTINUE                                                           HM150133
      GO TO 100                                                          HM150134
8     DF4=(DELTAX(IX-2)+DELTAX(IX-1))*(DELTAX(IX-2)+2.*                  HM150135
     1DELTAX(IX-1)+DELTAX(IX))                                           HM150136
      A(IX,IX-2)=1./DF4*(-2.*SVPLUS(IX)*(3.*DELTAX(IX)+                  HM150137
     1DELTAX(IX-1))-2.*SVMINU(IX)*(DELTAX(IX)-DELTAX(IX-1)))             HM150138
      DF5=(DELTAX(IX-2)+DELTAX(IX-1))*(DELTAX(IX-1)+DELTAX(IX))          HM150139
      A(IX,IX-1)=1./DF5*(2.*SVPLUS(IX)*(3.*DELTAX(IX)+2.                 HM150140
     1*DELTAX(IX-1)+DELTAX(IX-2))+2.*SVMINU(IX)*(DELTAX(IX)-2.*         HM150141
     2DELTAX(IX-1)-DELTAX(IX-2)))                                        HM150142
      DF6=(DELTAX(IX-2)+2.*DELTAX(IX-1)+DELTAX(IX))*(DELTAX(IX-1)        HM150143
     1+DELTAX(IX))                                                       HM150144
      A(IX,IX)=1./DF6*(-2.*SVPLUS(IX)*(4.*DELTAX(IX)+                    HM150145
     13.*DELTAX(IX-1)+DELTAX(IX-2))+2.*SVMINU(IX)*(3.*DELTAX(IX         HM150146
     2-1)+DELTAX(IX-2)))                                                 HM150147
      IF(XKR(L))32,100,32                                                HM150148
32    B(IX,IX-2)=1./DF4*(SVPLUS(IX)*DELTAX(IX)*(2.*                      HM150149
     1DELTAX(IX)+DELTAX(IX-1))+SVMINU(IX)*DELTAX(IX)*DELTAX(IX-1)+       HM150150
     22.*DELVOL(IX)*(DELTAX(IX)+DELTAX(IX-1)))                           HM150151
```

```
      B(IX,IX-1)=-1.0/DF5*(SVPLUS(IX)*DELTAX(IX)*(2.0*                    HM150152
     1DELTAX(IX)+2.0*DELTAX(IX-1)+DELTAX(IX-2))+SVMINU(I)*DELTAX(IX)     HM150153
     2*(2.0*DELTAX(IX-1)+DELTAX(IX-2))+2.0*DELVOL(IX)*(DELTAX(IX)+       HM150154
     32.0*DELTAX(IX-1)+DELTAX(IX-2)))                                    HM150155
      B(IX,IX)=1.0/DF6*(SVPLUS(IX)*(2.0*DELTAX(IX)+DELTAX(IX-1))         HM150156
     1*(2.0*DELTAX(IX)+2.0*DELTAX(IX-1)+DELTAX(IX-2))-SVMINU(IX)*        HM150157
     2DELTAX(IX-1)*(2.0*DELTAX(IX-1)+DELTAX(IX-2))+2.0*DELVOL(IX)        HM150158
     3*(2.0*DELTAX(IX)+3.0*DELTAX(IX-1)+DELTAX(IX-2)))                   HM150159
      C(IX,IX-2)=1.0/DF4*(DELTAX(IX)**2/6.0*(SVPLUS(IX)                  HM150160
     1-SVMINU(IX))*(DELTAX(IX)+DELTAX(IX-1)))*(-1.0)                     HM150161
      C(IX,IX-1)=1.0/DF5*(DELTAX(IX)**2/6.0*(SVPLUS(IX)-                 HM150162
     1SVMINU(IX))*(DELTAX(IX)+2.0*DELTAX(IX-1)+DELTAX(IX-2)))            HM150163
      C(IX,IX)=1.0/DF6*(D66*DELVOL(IX)+DELTAX(IX)**2/6.0                 HM150164
     1*(SVPLUS(IX)-SVMINU(IX))*(2.0*DELTAX(IX)+3.0*DELTAX(IX-1)         HM150165
     2+DELTAX(IX-2)))*(-2.0)                                             HM150166
100   CONTINUE                                                          HM150167
      WRITE OUTPUT TAPE N3,86,XKR(L),J1                                 HM150168
86    FORMAT(1E12.8,65X,1I3)                                            HM150169
      J1=J1+1                                                           HM150170
      WRITE OUTPUT TAPE N3,34,IX,J1                                     HM150171
34    FORMAT(1I4,73X,1I3)                                               HM150172
      J1=J1+1                                                           HM150173
      COEFZ=2.0/SREF                                                    HM150174
      IF(XKR(L))46,46,71                                                HM150175
46    DO 47 I=1,IX                                                      HM150176
      DO 47 J=1,IX                                                      HM150177
47    A(I,J)=COEFZ*CBAR*A(I,J)                                          HM150178
      IF(XKR(L))80,70,80                                                HM150179
80    DO 81 I=1,IX                                                      HM150180
      DO 81 J=1,IX                                                      HM150181
      C(I,J)=COEFZ/CBAR*C(I,J)                                          HM150182
      B(I,J)=COEFZ*B(I,J)                                               HM150183
81    CONTINUE                                                          HM150184
      IF(XKR(L))82,70,71                                                HM150185
82    WRITE OUTPUT TAPE N2,814                                          HM150186
      WRITE OUTPUT TAPE N2,78,XKR(L),IX                                 HM150187
78    FORMAT(1H 49X,7H 1L/KR=1E15.8//46X,10H NUMBER OF                  HM150188
     1  17H CONTROL POINTS =1I3//49X,14H THE TRANSIENT                   HM150189
```

```
     2  5H CASE//)                                                    HM150190
      WRITE OUTPUT TAPE N2,820                                        HM150191
 820  FORMAT(1H 49X,15H THE CHS MATRIX / )                            HM150192
      CALL MPRINT(A,IX,IX,50,N2)                                      HM150193
      IF(IPUNCH)302,301,302                                           HM150194
 301  IF(J1-2)833,834,833                                             HM150195
 834  J1=J2                                                           HM150196
      GO TO 702                                                       HM150197
 833  J1=J2+1                                                         HM150198
 702  J2=J1+(IX+IX/22)*3+4                                            HM150199
 302  WRITE OUTPUT TAPE N2,66                                         HM150200
 66   FORMAT( // 49X,15H THE CHD MATRIX / )                           HM150201
      CALL MPRINT(B,IX,IX,50,N2)                                      HM150202
 602  WRITE OUTPUT TAPE N2,67                                         HM150203
 67   FORMAT(// 49X,15H THE CHI MATRIX //)                            HM150204
      CALL MPRINT(C,IX,IX,50,N2)                                      HM150205
      WRITE OUTPUT TAPE N2,229,J1,J2                                  HM150206
      GO TO 800                                                       HM150207
 70   WRITE OUTPUT TAPE N2,814                                        HM150208
      WRITE OUTPUT TAPE N2,72,XKR(L),IX                               HM150209
 72   FORMAT(1H 49X,7H 1/KR=1E15.8//46X,10H NUMBER OF                 HM150210
     1  17H CONTROL POINTS =1I3//49X,16H THE STEADY CASE//)           HM150211
      CALL MPRINT(A,IX,IX,50,N2)                                      HM150212
      IF(IPUNCH)999,845,999                                           HM150213
 845  IF(J1-2)847,846,847                                             HM150214
 846  J1=J2                                                           HM150215
      GO TO 888                                                       HM150216
 847  J1=J2+1                                                         HM150217
 888  J2=J1+IX+IX/22*IX+2                                             HM150218
      WRITE OUTPUT TAPE N2,229,J1,J2                                  HM150219
 800  CONTINUE                                                        HM150220
B     CHS=606060233062                                                HM150221
      CALL MRUNCH(A,IX,IX,0,0,1,CHS,50,N3)                            HM150222
      IF(XKR(L))79,999,79                                             HM150223
 79   CONTINUE                                                        HM150224
B     CHD=606060233024                                                HM150225
B     CHI=606060233031                                                HM150226
      CALL MPUNCH(B,IX,IX,0,0,1,CHD,50,N3)                            HM150227
```

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      CALL MPUNCH(C,IX,IX,0,0,1,CHI,50,N3)                              HM150228
  229 FORMAT(/38X,24H PUNCHED CARDS NOS. HM151I3,                       HM150229
     1 10H THRU HM151I3)                                                HM150230
      GO TO 999                                                         HM150231
   71 WRITE OUTPUT TAPE N2,814                                          HM150232
      WRITE OUTPUT TAPE N2,85,XKR(L),IX                                 HM150233
   85 FORMAT(1H 49X,7H 1I/KR=1E15.8//46X,10H NUMBER OF                  HM150234
     1  16H CONTROL POINTS=1I3//48X,16H THE OSCILLATORY                 HM150235
     2  5H CASE//)                                                      HM150236
      WRITE OUTPUT TAPE N2,919                                          HM150237
  919 FORMAT(1H 12X,4HREAL 11X,9HIMAGINARY 11X,4HREAL 10X,              HM150238
     1  9HIMAGINARY 10X,4HREAL 11X,9HIMAGINARY //)                     HM150239
      IX2=2*IX                                                          HM150240
      DO 35 I=1,IX                                                      HM150241
      DO 35 J=1,IX2,2                                                   HM150242
      KZ=J/2+1                                                          HM150243
      CH(I,J)=COEFA*A(I,KZ)-(1./(BR**2*S)*C(I,KZ))                      HM150244
      CH(I,J+1)=XKR(L)/(BR*S)*B(I,KZ)                                   HM150245
   35 CONTINUE                                                          HM150246
      CALL MPRINT(CH,IX,IX2,50,N2)                                      HM150247
      IF(IPUNCH)999,65,999                                              HM150248
   65 CONTINUE                                                          HM150249
B     CHM=606060233044                                                  HM150250
      CALL MPUNCH(CH,IX,IX2,0,0,1,CHM,50,N3)                            HM150251
      IF(J1-2)887,889,887                                               HM150252
  889 J1=J2                                                             HM150253
      GO TO 631                                                         HM150254
  887 J1=J2+1                                                           HM150255
  631 J2=J1+2+(IX+IX/22)*2                                              HM150256
      WRITE OUTPUT TAPE N2,229,J1,J2                                    HM150257
  999 CONTINUE                                                          HM150258
      END FILE N3                                                       HM150259
      GO TO 2                                                           HM150260
      END(1,1,0,0,0,0,0,1,0,1,0,0,0,0,0)
```

STORAGE NOT USED BY PROGRAM

DEC	OCT	DEC	OCT
12468	30264	32561	77461

STORAGE LOCATIONS FOR VARIABLES APPEARING IN DIMENSION AND EQUIVALENCE STATEMENTS

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
A	11953	27261	B	9453	22355	CH	6953	15451	C	4453	10545
DELTAX	12165	27605	DELVOL	12215	27667	SVAR	12467	30263	SVMINU	12366	30116
SVPLUS	12416	30200	TITLE	12015	27357	XKR	12003	27343	XMINUS	12065	27441
XN	12265	27751	XPLUS	12115	27523	X	12316	30034			

STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN COMMON, DIMENSION, OR EQUIVALENCE STATEMENTS

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
BR	1953	03641	CBAR	1952	03640	CHD	1951	03637	CHI	1950	03636
CHM	1949	03635	CHS	1948	03634	COEFA	1947	03633	COEFZ	1946	03632
DF1	1945	03631	DF2	1944	03630	DF3	1943	03627	DF4	1942	03626
DF5	1941	03625	DF6	1940	03624	DF7	1939	03623	DF8	1938	03622
DF9	1937	03621	IPUNCH	1936	03620	I	1935	03617	IX1	1934	03616
IX2	1933	03615	IX	1932	03614	J1	1931	03613	J2	1930	03612
J	1929	03611	KS	1928	03610	KVBRW	1927	03607	KZ	1926	03606
M1	1925	03605	M	1924	03604	N1	1923	03603	N2	1922	03602
N3	1921	03601	N	1920	03600	SREF	1919	03577	S	1918	03576

SYMBOLS AND LOCATIONS FOR SOURCE PROGRAM FORMAT STATEMENTS

	EFN	LOC		EFN	LOC		EFN	LOC		EFN	LOC
8)1	1	03547	8)3	3	03546	8)4	4	03473	8)12	34	03354
8)18	40	03545	8)19	41	03542	8)1D	45	03410	8)22	66	03315
8)23	67	03307	8)28	72	03302	8)2E	78	03351	8)2L	85	03242
8)2M	86	03357	8)3J	115	03434	8)43	131	03540	8)4C	140	03415
8)75	229	03257	8)FL	501	03536	8)PD	813	03533	8)PE	814	03513
8)RK	820	03322	8)SN	919	03213						

LOCATIONS FOR OTHER SYMBOLS NOT APPEARING IN SOURCE PROGRAM

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
1)	1896	03550	2)	1634	03142	3)	1642	03152	4)	32767	77777
6)	1652	03164	A)102	1608	03110	A)103	1621	03125	C)G0	1906	03562
C)G1	1907	03563	C)G2	1908	03564	C)G4	1909	03565	C)G5	1910	03566
C)100	1911	03567	C)102	1912	03570	C)103	1913	03571	C)200	1914	03572
C)201	1915	03573	C)202	1916	03574	C)900	1917	03575	D)112	656	01220
D)116	760	01370	D)118	844	01514	D)11C	1114	02132	D)200	262	00406
D)22E	1597	03075	D)318	843	01513	D)32E	1596	03074	D)401	15	00017
D)40U	559	01057	D)426	1474	02702	D)51C	1113	02131	D)526	1473	02701
D)601	14	00016	D)718	842	01512	E)V	565	01065	E)11	647	01207
E)1Q	1243	02333	E)1T	1265	02361	E)12E	1599	03077			

LOCATIONS OF NAMES IN TRANSFER VECTOR

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
MPRINT	6	00006	MPUNCH	7	00007	(EFT)	8	00010	(FIL)	5	00005
(FPT)	0	00000	(RTN)	2	00002	(RWT)	3	00003	(STH)	4	00004
(TSH)	1	00001									

ENTRY POINTS TO SUBROUTINES NOT OUTPUT FROM LIBRARY

MPRINT MPUNCH (EFT) (FIL) (FPT) (RTN) (RWT) (STH)
(TSH)

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC
2	25	00020	21	63	00213	109	66	00224	112	87	00350
22	93	00373	5	102	00452	25	109	00606	6	116	01043
7	117	01047	9	119	01070	30	122	01134	10	125	01212
11	126	01221	31	129	01265	12	132	01355	13	133	01371
14	136	01434	97	138	01515	8	140	01525	32	147	01665
100	153	02133	46	162	02207	47	164	02222	80	166	02236
81	170	02260	82	172	02270	301	179	02326	834	180	02334
833	182	02337	702	183	02342	302	184	02362	602	187	02400

70	193	02435	845	199	02470	846	200	02475	847	202	02500
888	203	02503	800	206	02532	79	211	02555	71	219	02621
35	229	02751	65	233	03006	889	238	03033	887	240	03036
631	241	03041	999	244	03100						

```
00000 -342647633460 00  (FPT)  BCD 1(FPT)
00001 -346362303460 00  (TSH)  BCD 1(TSH)
00002 -345163453460 00  (RTN)  BCD 1(RTN)
00003 -345166633460 00  (RWT)  BCD 1(RWT)
00004 -346263303460 00  (STH)  BCD 1(STH)
00005 -342631433460 00  (FIL)  BCD 1(FIL)
00006 -044751314563 00  MPRINT BCD 1MPRINT
00007 -044764452330 00  MPUNCH BCD 1MPUNCH
00010 -342526633460 00  (EFT)  BCD 1(EFT)
00011 +050000000002 00  $$     CLA 2
00012 +060100003171 010         STO 6)+5
00013 +050000000000 010         CLA (FPT)
00014 +060100000010 00          STO 8
00015 +060000077462 010         STZ 4)-205
00016 -053400203570 010 B)601   LXD C)102,2
00017 -053400403566 010 B)401   LXD C)G5,4
00020 +050000003142 010 25A     CLA 2)
00021 +060100003603 010         STO N1
00022 +050000003143 010 26A     CLA 2)+1
00023 +060100003602 010         STO N2
00024 +050000003144 010 27A     CLA 2)+2
00025 +060100003601 010         STO N3
00026 +050000003145 010 28A     CLA 2)+3
00027 +060100003605 010         STO M1
00030 -050000003603 010 29A     CAL N1
00031 -063400403170 010         SXD 6)+4,4
00032 +007400400001 010         TSX (TSH),4
00033 +000000003547 010         PZE 8)1
00034 -053400403170 010         LXD 6)+4,4
00035 -053400103145 010 30A     LXD 2)+3,1
00036 -100000000000 00  31A     STR
00037 -060000127360 010         STQ TITLE+1,1
00040 +100001100041 010 31A1    TXI *+1,1,1
00041 -300014100036 010 31A2    TXL 31A,1,12
                        33A     BSS
00042 +007400400002 010         TSX (RTN),4
00043 -050000003603 010 34A     CAL N1
00044 +007400400001 010         TSX (TSH),4
00045 +000000003546 010         PZE 8)3
00046 -100000000000 00  35A     STR
00047 -060000003614 010         STQ IX
00050 -100000000000 00          STR
00051 -060000003607 010         STQ KVBRW
00052 -100000000000 00          STR
00053 -060000003620 010         STQ IPUNCH
00054 +007400400002 010         TSX (RTN),4
00055 +007400403110 010         TSX A)102,4
00056 -053400203570 010         LXD C)102,2
00057 -053400403614 010         LXD IX,4
00060 -063400403566 010         SXD C)G5,4
00061 +050000003614 010 36A     CLA IX
00062 +040000003145 010         ADD 2)+3
00063 +060100003616 010         STO IX1
00064 -050000003603 010 37A     CAL N1
00065 -063400403170 010         SXD 6)+4,4
00066 +007400400001 010         TSX (TSH),4
00067 +000000003545 010         PZE 8)18
00070 -053400403170 010         LXD 6)+4,4
00071 -100000000000 00  38A     STR
00072 -060000003640 010         STQ CBAR
00073 -100000000000 00          STR
00074 -060000003641 010         STQ BR
00075 -100000000000 00          STR
00076 -060000003576 010         STQ S
00077 -100000000000 00          STR
00100 -060000003577 010         STQ SREF
00101 -053400103145 010 39A     LXD 2)+3,1
00102 +050000003616 010         CLA IX1
00103 +062200000107 010         STD 40A2
00104 -100000000000 00  40A     STR
00105 -060000130035 010         STQ X+1,1
00106 +100001100107 010 40A1    TXI *+1,1,1
00107 -300000100104 010 40A2    TXL 40A,1
00110 -063400403170 010 42A     SXD 6)+4,4
00111 +007400400002 010         TSX (RTN),4
00112 -053400403170 010         LXD 6)+4,4
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00113 -050000003603 010 43A   CAL N1
00114 -063400403170 010       SXD 6)+4,4
00115 +007400400001 010       TSX (TSH),4
00116 +000000003542 010       PZE 8)19
00117 -053400403170 010       LXD 6)+4,4
00120 -053400103145 010 44A   LXD 2)+3,1
00121 +050000003616 010       CLA IX1
00122 +062200000126 010       STD 45A2
00123 -100000000000 00  45A   STR
00124 -060000130264 011       STQ SVAR+1,1
00125 +100001100126 010 45A1  TXI *+1,1,1
00126 -300000100123 010 45A2  TXL 45A,1
00127 -063400403170 010 47A   SXD 6)+4,4
00130 +007400400002 010       TSX (RTN),4
00131 -053400403170 010       LXD 6)+4,4
00132 -050000003603 010 48A   CAL N1
00133 -063400403170 010       SXD 6)+4,4
00134 +007400400001 010       TSX (TSH),4
00135 +000000003540 010       PZE 8)43
00136 -053400403170 010       LXD 6)+4,4
00137 -053400103145 010 49A   LXD 2)+3,1
00140 +050000003607 010       CLA KVBRW
00141 +062200000145 010       STD 50A2
00142 -100000000000 00  50A   STR
00143 -060000127344 010       STQ XKR+1,1
00144 +100001100145 010 50A1  TXI *+1,1,1
00145 -300000100142 010 50A2  TXL 50A,1
00146 -063400403170 010 52A   SXD 6)+4,4
00147 +007400400002 010       TSX (RTN),4
00150 -053400403170 010       LXD 6)+4,4
00151 -050000003601 010 53A   CAL N3
00152 -063400403170 010       SXD 6)+4,4
00153 +007400400003 010       TSX (RWT),4
00154 -053400403170 010       LXD 6)+4,4
00155 -053400103145 010 54A   LXD 2)+3,1
00156 +050000003614 010       CLA IX
00157 +062200000215 010       STD 63A2
00160 -075400100000 00        PXD 0,1
00161 +060100003617 010       STO I
00162 +050000003617 010 55A   CLA I
00163 +040000003145 010       ADD 2)+3
00164 +060100003600 010       STO N
00165 -053400203600 010       LXD N,2
00166 -063400203564 010       SXD C)G2,2
00167 +050000230035 010 56A   CLA X+1,2
00170 +060100127524 010       STO XPLUS+1,1
00171 +050000130035 010 57A   CLA X+1,1
00172 +060100127442 010       STO XMINUS+1,1
00173 +050000127524 010 58A   CLA XPLUS+1,1
00174 +030200127442 010       FSB XMINUS+1,1
00175 +060100127606 010       STO DELTAX+1,1
00176 +050000127524 010 59A   CLA XPLUS+1,1
00177 +030000127442 010       FAD XMINUS+1,1
00200 +024100003152 010       FDP 3)
00201 -060000127752 010       STQ XN+1,1
00202 +050000230264 011 60A   CLA SVAR+1,2
00203 +060100130201 010       STO SVPLUS+1,1
00204 +050000130264 011 61A   CLA SVAR+1,1
00205 +060100130117 010       STO SVMINU+1,1
00206 +050000130201 010 62A   CLA SVPLUS+1,1
00207 +030000130117 010       FAD SVMINU+1,1
00210 +024100003152 010       FDP 3)
00211 +026000127606 010       FMP DELTAX+1,1
00212 +060100127670 010       STO DELVOL+1,1
                          63A BSS
00213 +100001100214 010 63A1  TXI *+1,1,1
00214 -063400103617 010       SXD I,1
00215 -300000100162 010 63A2  TXL 55A,1
00216 +050000003146 010 64A   CLA 2)+4
00217 +060100003613 010       STO J1
00220 +050000003605 010 65A   CLA M1
00221 +040200003145 010       SUB 2)+3
00222 +010000000224 010 65A1  TZE 66A
00223 +012000000350 010       TPL 87A
00224 -050000003602 010 66A   CAL N2
00225 -063400403170 010       SXD 6)+4,4
```

```
00226 +007400400004 010       TSX (STH),4
00227 +000000003536 010       PZE 8)FL
00230 -053400403170 010       LXD 6)+4,4
00231 -053400103145 010 67A   LXD 2)+3,1
00232 +056000127360 010 68A   LDQ TITLE+1,1
00233 -100000000000 00        STR
00234 +100001100235 010 68A1  TXI *+1,1,1
00235 -300014100232 010 68A2  TXL 68A,1,12
00236 -063400403170 010 70A   SXD 6)+4,4
00237 +007400400005 010       TSX (FIL),4
00240 -053400403170 010       LXD 6)+4,4
00241 -050000003602 010 71A   CAL N2
00242 -063400403170 010       SXD 6)+4,4
00243 +007400400004 010       TSX (STH),4
00244 +000000003533 010       PZE 8)PD
00245 +007400400005 010       TSX (FIL),4
00246 -053400403170 010       LXD 6)+4,4
00247 -050000003602 010 72A   CAL N2
00250 -063400403170 010       SXD 6)+4,4
00251 +007400400004 010       TSX (STH),4
00252 +000000003473 010       PZE 8)4
00253 -053400403170 010       LXD 6)+4,4
00254 +056000003614 010 73A   LDQ IX
00255 -100000000000 00        STR
00256 +056000003607 010       LDQ KVBRW
00257 -100000000000 00        STR
00260 +056000003640 010       LDQ CBAR
00261 -100000000000 00        STR
00262 +056000003641 010       LDQ BR
00263 -100000000000 00        STR
00264 +056000003576 010       LDQ S
00265 -100000000000 00        STR
00266 +056000003577 010       LDQ SREF
00267 -100000000000 00        STR
00270 -063400403170 010       SXD 6)+4,4
00271 +007400400005 010       TSX (FIL),4
00272 -053400403170 010       LXD 6)+4,4
00273 -050000003602 010 74A   CAL N2
00274 -063400403170 010       SXD 6)+4,4
00275 +007400400004 010       TSX (STH),4
00276 +000000003434 010       PZE 8)3J
00277 -053400403170 010       LXD 6)+4,4
00300 -053400103145 010 75A   LXD 2)+3,1
00301 +050000003616 010       CLA IX1
00302 +062200000310 010       STD 76A2
00303 +056000130035 010 76A   LDQ X+1,1
00304 -100000000000 00        STR
00305 +056000130264 011       LDQ SVAR+1,1
00306 -100000000000 00        STR
00307 +100001100310 010 76A1  TXI *+1,1,1
00310 -300000100303 010 76A2  TXL 76A,1
00311 -063400403170 010 78A   SXD 6)+4,4
00312 +007400400005 010       TSX (FIL),4
00313 -053400403170 010       LXD 6)+4,4
00314 -050000003602 010 79A   CAL N2
00315 -063400403170 010       SXD 6)+4,4
00316 +007400400004 010       TSX (STH),4
00317 +000000003415 010       PZE 8)4C
00320 +007400400005 010       TSX (FIL),4
00321 -053400403170 010       LXD 6)+4,4
00322 -050000003602 010 80A   CAL N2
00323 -063400403170 010       SXD 6)+4,4
00324 +007400400004 010       TSX (STH),4
00325 +000000003410 010       PZE 8)1D
00326 -053400403170 010       LXD 6)+4,4
00327 -053400103145 010 81A   LXD 2)+3,1
00330 +050000003614 010       CLA IX
00331 +062200000344 010       STD 84A2
00332 -075400100000 00        PXD 0,1
00333 +060100003617 010       STO I
                        82A   BSS
00334 +056000003617 010 84A   LDQ I
00335 -100000000000 00        STR
00336 +056000127606 010       LDQ DELTAX+1,1
00337 -100000000000 00        STR
00340 +056000127752 010       LDQ XN+1,1
```

```
00341 -100000000000 00          STR
00342 +100001100343 010 84A1    TXI  *+1,1,1
00343 -063400103617 010         SXD  I,1
00344 -300000100334 010 84A2    TXL  82A,1
00345 -063400403170 010 86A     SXD  6)+4,4
00346 +007400400005 010         TSX  (FIL),4
00347 -053400403170 010         LXD  6)+4,4
00350 +050000003145 010 87A     CLA  2)+3
00351 +060100003612 010         STO  J2
00352 -053400103145 010 88A     LXD  2)+3,1
00353 +050000003614 010         CLA  IX
00354 +062200000377 010         STD  93A4
00355 +056000003614 010         LDQ  IX
00356 +020000003147 010         MPY  2)+5
00357 +076700000021 00          ALS  17
00360 +062200000374 010         STD  93A2
00361 +056000003614 010         LDQ  IX
00362 +020000003147 010         MPY  2)+5
00363 +076700000021 00          ALS  17
00364 +062200000375 010         STD  93A3
                        89A     BSS
00365 +050000003153 010 90A     CLA  3)+1
00366 +060100127262 010         STO  A+1,1
00367 +050000003153 010 91A     CLA  3)+1
00370 +060100122356 010         STO  B+1,1
00371 +050000003153 010 92A     CLA  3)+1
00372 +060100110546 010         STO  C+1,1
                        93A     BSS
00373 +100062100374 010 93A1    TXI  *+1,1,50
00374 -300000100365 010 93A2    TXL  90A,1
00375 +200000100376 010 93A3    TIX  *+1,1
00376 +100001100377 010         TXI  *+1,1,1
00377 -300000100365 010 93A4    TXL  89A,1
00400 +050000003142 010 94A     CLA  2)
00401 +060100003605 010         STO  M1
00402 -053400103145 010 95A     LXD  2)+3,1
00403 -063400103563 010         SXD  C)G1,1
00404 +050000003607 010         CLA  KVBRW
00405 +062200003102 010         STD  244A2
00406 -053400203570 010 D)200   LXD  C)102,2
00407 +056000127344 010 96A     LDQ  XKR+1,1
00410 +026000127344 010         FMP  XKR+1,1
00411 +024100003576 010         FDP  S
00412 -060000003633 010         STQ  COEFA
00413 +056000003614 010 97A     LDQ  IX
00414 +020000003614 010         MPY  IX
00415 +076700000021 00          ALS  17
00416 +060100003610 010         STO  KS
00417 -053400103145 010 98A     LXD  2)+3,1
00420 -063400103567 010         SXD  C)100,1
00421 +056000003614 010         LDQ  IX
00422 +020000003147 010         MPY  2)+5
00423 +076700000021 00          ALS  17
00424 +062200001522 010         STD  138A3
00425 -053400103145 010         LXD  2)+3,1
00426 -063400103562 010         SXD  C)G0,1
00427 +050000003614 010         CLA  IX
00430 +062200002141 010         STD  153A2
00431 -075400100000 00          PXD  0,1
00432 +060100003617 010         STO  I
00433 +050000003617 010 99A     CLA  I
00434 +040200003145 010         SUB  2)+3
00435 +060100003604 010         STO  M
00436 -053400203604 010         LXD  M,2
00437 -063400203565 010         SXD  C)G4,2
00440 +050000003617 010 100A    CLA  I
00441 +040000003145 010         ADD  2)+3
00442 +060100003600 010         STO  N
00443 -053400203600 010         LXD  N,2
00444 -063400203564 010         SXD  C)G2,2
00445 +050000003617 010 101A    CLA  I
00446 +040200003145 010         SUB  2)+3
00447 +010000000452 010 101A1   TZE  102A
00450 +012000001043 010         TPL  116A
00451 +002000001043 010         TRA  116A
00452 +056000003152 010 102A    LDQ  3)
```

```
00453 +026000027604 010        FMP DELTAX-1
00454 +030000027605 010        FAD DELTAX
00455 +030000027603 010        FAD DELTAX-2
00456 +060100003551 010        STO 1)+1
00457 +050000027605 010        CLA DELTAX
00460 +030000027604 010        FAD DELTAX-1
00461 +013100000000 00         XCA
00462 +026000003551 010        FMP 1)+1
00463 +060100003631 010        STO DF1
00464 +050000027604 010 103A   CLA DELTAX-1
00465 +030000027603 010        FAD DELTAX-2
00466 +060100003551 010        STO 1)+1
00467 +050000027605 010        CLA DELTAX
00470 +030000027604 010        FAD DELTAX-1
00471 +013100000000 00         XCA
00472 +026000003551 010        FMP 1)+1
00473 +060100003630 010        STO DF2
00474 +050000027604 010 104A   CLA DELTAX-1
00475 +030000027603 010        FAD DELTAX-2
00476 +060100003551 010        STO 1)+1
00477 +056000003152 010        LDQ 3)
00500 +026000027604 010        FMP DELTAX-1
00501 +030000027605 010        FAD DELTAX
00502 +030000027603 010        FAD DELTAX-2
00503 +013100000000 00         XCA
00504 +026000003551 010        FMP 1)+1
00505 +060100003627 010        STO DF3
00506 +056000003154 010 105A   LDQ 3)+2
00507 +026000027604 010        FMP DELTAX-1
00510 +060100003551 010        STO 1)+1
00511 +056000003155 010        LDQ 3)+3
00512 +026000027605 010        FMP DELTAX
00513 +030000003551 010        FAD 1)+1
00514 +030000027603 010        FAD DELTAX-2
00515 +013100000000 00         XCA
00516 +026000003152 010        FMP 3)
00517 +013100000000 00         XCA
00520 +026000030116 010        FMP SVMINU
00521 +060100003553 010        STO 1)+3
00522 +050000003551 010        CLA 1)+1
00523 +030000027603 010        FAD DELTAX-2
00524 +013100000000 00         XCA
00525 +026000003152 010        FMP 3)
00526 +013100000000 00         XCA
00527 +026000030200 010        FMP SVPLUS
00530 +030200003553 010        FSB 1)+3
00531 +024100003631 010        FDP DF1
00532 -060000027261 010        STQ A
00533 +056000003152 010 106A   LDQ 3)
00534 +026000027604 010        FMP DELTAX-1
00535 +060100003551 010        STO 1)+1
00536 +056000003154 010        LDQ 3)+2
00537 +026000027605 010        FMP DELTAX
00540 +030000003551 010        FAD 1)+1
00541 +030000027603 010        FAD DELTAX-2
00542 +013100000000 00         XCA
00543 +026000003152 010        FMP 3)
00544 +013100000000 00         XCA
00545 +026000030116 010        FMP SVMINU
00546 +060100003553 010        STO 1)+3
00547 +050000027605 010        CLA DELTAX
00550 +030200003551 010        FSB 1)+1
00551 +030200027603 010        FSB DELTAX-2
00552 +013100000000 00         XCA
00553 +026000003152 010        FMP 3)
00554 +013100000000 00         XCA
00555 +026000030200 010        FMP SVPLUS
00556 +030000003553 010        FAD 1)+3
00557 +024100003630 010        FDP DF2
00560 -060000027177 010        STQ A-50
00561 +056000003154 010 107A   LDQ 3)+2
00562 +026000027605 010        FMP DELTAX
00563 +030000027604 010        FAD DELTAX-1
00564 +013100000000 00         XCA
00565 +026000003152 010        FMP 3)
00566 +013100000000 00         XCA
```

```
00567 +026000030116 010        FMP  SVMINU
00570 +060100003552 010        STO  1)+2
00571 +050000027605 010        CLA  DELTAX
00572 +030200027604 010        FSB  DELTAX-1
00573 +013100000000 00         XCA
00574 +026000003152 010        FMP  3)
00575 +013100000000 00         XCA
00576 +026000030200 010        FMP  SVPLUS
00577 +076000000002 00         CHS
00600 +030200003552 010        FSB  1)+2
00601 +024100003627 010        FDP  DF3
00602 -060000027115 010        STQ  A-100
00603 -053400203563 010        LXD  C)G1,2
00604 +050000227344 010 108A   CLA  XKR+1,2
00605 +010000002133 010 108A1  TZE  153A
00606 +056000003154 010 109A   LDQ  3)+2
00607 +026000027604 010        FMP  DELTAX-1
00610 +060100003551 010        STO  1)+1
00611 +056000003152 010        LDQ  3)
00612 +026000027605 010        FMP  DELTAX
00613 +060100003552 010        STO  1)+2
00614 +030000003551 010        FAD  1)+1
00615 +030000027603 010        FAD  DELTAX-2
00616 +013100000000 00         XCA
00617 +026000003152 010        FMP  3)
00620 +013100000000 00         XCA
00621 +026000027667 010        FMP  DELVOL
00622 +060100003554 010        STO  1)+4
00623 +056000003152 010        LDQ  3)
00624 +026000027604 010        FMP  DELTAX-1
00625 +060100003555 010        STO  1)+5
00626 +030000003552 010        FAD  1)+2
00627 +030000027603 010        FAD  DELTAX-2
00630 +060100003556 010        STO  1)+6
00631 +050000003552 010        CLA  1)+2
00632 +030000027604 010        FAD  DELTAX-1
00633 +060100003557 010        STO  1)+7
00634 +056000003556 010        LDQ  1)+6
00635 +026000030116 010        FMP  SVMINU
00636 +013100000000 00         XCA
00637 +026000003557 010        FMP  1)+7
00640 +060100003560 010        STO  1)+8
00641 +050000003555 010        CLA  1)+5
00642 +030000027603 010        FAD  DELTAX-2
00643 +013100000000 00         XCA
00644 +026000030200 010        FMP  SVPLUS
00645 +013100000000 00         XCA
00646 +026000027604 010        FMP  DELTAX-1
00647 +030200003560 010        FSB  1)+8
00650 +030200003554 010        FSB  1)+4
00651 +024100003631 010        FDP  DF1
00652 -060000022355 010        STQ  B
00653 +056000003152 010 110A   LDQ  3)
00654 +026000027604 010        FMP  DELTAX-1
00655 +060100003551 010        STO  1)+1
00656 +030000027605 010        FAD  DELTAX
00657 +030000027603 010        FAD  DELTAX-2
00660 +013100000000 00         XCA
00661 +026000003152 010        FMP  3)
00662 +013100000000 00         XCA
00663 +026000027667 010        FMP  DELVOL
00664 +060100003553 010        STO  1)+3
00665 +056000003152 010        LDQ  3)
00666 +026000027605 010        FMP  DELTAX
00667 +030000003551 010        FAD  1)+1
00670 +030000027603 010        FAD  DELTAX-2
00671 +013100000000 00         XCA
00672 +026000030116 010        FMP  SVMINU
00673 +013100000000 00         XCA
00674 +026000027605 010        FMP  DELTAX
00675 +060100003555 010        STO  1)+5
00676 +050000003551 010        CLA  1)+1
00677 +030000027603 010        FAD  DELTAX-2
00700 +013100000000 00         XCA
00701 +026000030200 010        FMP  SVPLUS
00702 +013100000000 00         XCA
```

```
00703 +026000027605 010        FMP DELTAX
00704 +030000003555 010        FAD 1)+5
00705 +030000003553 010        FAD 1)+3
00706 +024100003630 010        FDP DF2
00707 -060000022273 010        STQ B-50
00710 +050000027605 010 111A   CLA DELTAX
00711 +030000027604 010        FAD DELTAX-1
00712 +013100000000 00         XCA
00713 +026000003152 010        FMP 3)
00714 +013100000000 00         XCA
00715 +026000027667 010        FMP DELVOL
00716 +060100003552 010        STO 1)+2
00717 +056000003152 010        LDQ 3)
00720 +026000027605 010        FMP DELTAX
00721 +030000027604 010        FAD DELTAX-1
00722 +013100000000 00         XCA
00723 +026000030116 010        FMP SVMINU
00724 +013100000000 00         XCA
00725 +026000027605 010        FMP DELTAX
00726 +060100003554 010        STO 1)+4
00727 +056000027604 010        LDQ DELTAX-1
00730 +026000030200 010        FMP SVPLUS
00731 +013100000000 00         XCA
00732 +026000027605 010        FMP DELTAX
00733 +030000003554 010        FAD 1)+4
00734 +030000003552 010        FAD 1)+2
00735 +024100003627 010        FDP DF3
00736 +026000003156 010        FMP 3)+4
00737 +076000000002 00         CHS
00740 +060100022211 010        STO B-100
00741 +050200003156 010 112A   CLS 3)+4
00742 +060100003551 010        STO 1)+1
00743 +056000003154 010        LDQ 3)+2
00744 +026000027604 010        FMP DELTAX-1
00745 +060100003552 010        STO 1)+2
00746 +056000003152 010        LDQ 3)
00747 +026000027605 010        FMP DELTAX
00750 +030000003552 010        FAD 1)+2
00751 +030000027603 010        FAD DELTAX-2
00752 +060100003553 010        STO 1)+3
00753 +050000030200 010        CLA SVPLUS
00754 +030200030116 010        FSB SVMINU
00755 +060100003554 010        STO 1)+4
00756 +056000027605 010        LDQ DELTAX
00757 +026000027605 010        FMP DELTAX
00760 +060100003555 010        STO 1)+5
00761 +056000003553 010        LDQ 1)+3
00762 +026000003555 010        FMP 1)+5
00763 +024100003157 010        FDP 3)+5
00764 +026000003554 010        FMP 1)+4
00765 +060100003556 010        STO 1)+6
00766 +056000003631 010        LDQ DF1
00767 +026000027667 010        FMP DELVOL
00770 +030200003556 010        FSB 1)+6
00771 +060100003557 010        STO 1)+7
00772 +056000003551 010        LDQ 1)+1
00773 +026000003156 010        FMP 3)+4
00774 +024100003631 010        FDP DF1
00775 +026000003557 010        FMP 1)+7
00776 +060100010545 010        STO C
00777 +056000003152 010 113A   LDQ 3)
01000 +026000027604 010        FMP DELTAX-1
01001 +030000027605 010        FAD DELTAX
01002 +030000027603 010        FAD DELTAX-2
01003 +060100003551 010        STO 1)+1
01004 +050000030200 010        CLA SVPLUS
01005 +030200030116 010        FSB SVMINU
01006 +060100003552 010        STO 1)+2
01007 +056000027605 010        LDQ DELTAX
01010 +026000027605 010        FMP DELTAX
01011 +060100003553 010        STO 1)+3
01012 +056000003551 010        LDQ 1)+1
01013 +026000003553 010        FMP 1)+3
01014 +024100003157 010        FDP 3)+5
01015 +026000003552 010        FMP 1)+2
01016 +024100003630 010        FDP DF2
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```
01017 +026000003156 010       FMP 3)+4
01020 +076000000002 00        CHS
01021 +060100010463 010       STO C-50
01022 +050000027605 010 114A  CLA DELTAX
01023 +030000027604 010       FAD DELTAX-1
01024 +060100003551 010       STO 1)+1
01025 +050000030200 010       CLA SVPLUS
01026 +030200030116 010       FSB SVMINU
01027 +060100003552 010       STO 1)+2
01030 +056000027605 010       LDQ DELTAX
01031 +026000027605 010       FMP DELTAX
01032 +060100003553 010       STO 1)+3
01033 +056000003551 010       LDQ 1)+1
01034 +026000003553 010       FMP 1)+3
01035 +024100003157 010       FDP 3)+5
01036 +026000003552 010       FMP 1)+2
01037 +024100003627 010       FDP DF3
01040 +026000003156 010       FMP 3)+4
01041 +060100010401 010       STO C-100
01042 +002000002133 010 115A  TRA 153A
01043 +050000003617 010 116A  CLA I
01044 +040200003614 010       SUB IX
01045 +010000001525 010 116A1 TZE 140A
01046 +012000001525 010       TPL 140A
01047 -053400103145 010 117A  LXD 2)+3,1
01050 -063400103574 010       SXD C)202,1
01051 +050000003614 010       CLA IX
01052 +062200001521 010       STD 138A2
01053 -075400100000 00        PXD 0,1
01054 +060100003611 010       STO J
01055 -053400203166 010       LXD 6)+2,2
01056 -063400203575 010       SXD C)900,2
01057 -053400403567 010 D)40U LXD C)100,4
01060 +050000003611 010 118A  CLA J
01061 +040200003604 010       SUB M
01062 +010000001065 010 118A1 TZE E)V
01063 +012000001207 010       TPL E)11
01064 +002000001515 010       TRA 138A
01065 -063400403567 010 E)V   SXD C)100,4
01066 -063400203575 010       SXD C)900,2
01067 -063400103574 010       SXD C)202,1
01070 +056000003152 010 119A  LDQ 3)
01071 -053400103562 010       LXD C)G0,1
01072 +026000127606 010       FMP DELTAX+1,1
01073 -053400203565 010       LXD C)G4,2
01074 +030000227606 010       FAD DELTAX+1,2
01075 -053400403564 010       LXD C)G2,4
01076 +030000427606 010       FAD DELTAX+1,4
01077 +060100003551 010       STO 1)+1
01100 +050000227606 010       CLA DELTAX+1,2
01101 +030000127606 010       FAD DELTAX+1,1
01102 +013100000000 00        XCA
01103 +026000003551 010       FMP 1)+1
01104 +060100003623 010       STO DF7
01105 +056000003154 010 120A  LDQ 3)+2
01106 +026000127606 010       FMP DELTAX+1,1
01107 +030000427606 010       FAD DELTAX+1,4
01110 +013100000000 00        XCA
01111 +026000003152 010       FMP 3)
01112 +013100000000 00        XCA
01113 +026000130117 010       FMP SVMINU+1,1
01114 +060100003552 010       STO 1)+2
01115 +050000127606 010       CLA DELTAX+1,1
01116 +030200427606 010       FSB DELTAX+1,4
01117 +013100000000 00        XCA
01120 +026000003152 010       FMP 3)
01121 +013100000000 00        XCA
01122 +026000130201 010       FMP SVPLUS+1,1
01123 +076000000002 00        CHS
01124 +030200003552 010       FSB 1)+2
01125 +024100003623 010       FDP DF7
01126 +026000003156 010       FMP 3)+4
01127 -053400203567 010       LXD C)100,2
01130 +060100227262 010       STO A+1,2
01131 -053400203563 010       LXD C)G1,2
01132 +050000227344 010 121A  CLA XKR+1,2
```

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01133 +010000001512 010 121A1  TZE D)718
01134 +050000127606 010 122A   CLA DELTAX+1,1
01135 +030000427606 010        FAD DELTAX+1,4
01136 +013100000000 00         XCA
01137 +026000003152 010        FMP 3)
01140 +013100000000 00         XCA
01141 +026000127670 010        FMP DELVOL+1,1
01142 +060100003552 010        STO 1)+2
01143 +056000003152 010        LDQ 3)
01144 +026000127606 010        FMP DELTAX+1,1
01145 +030000427606 010        FAD DELTAX+1,4
01146 +013100000000 00         XCA
01147 +026000130117 010        FMP SVMINU+1,1
01150 +013100000000 00         XCA
01151 +026000127606 010        FMP DELTAX+1,1
01152 +060100003554 010        STO 1)+4
01153 +056000427606 010        LDQ DELTAX+1,4
01154 +026000130201 010        FMP SVPLUS+1,1
01155 +013100000000 00         XCA
01156 +026000127606 010        FMP DELTAX+1,1
01157 +030000003554 010        FAD 1)+4
01160 +030000003552 010        FAD 1)+2
01161 +024100003623 010        FDP DF7
01162 +026000003156 010        FMP 3)+4
01163 +076000000002 00         CHS
01164 -053400203567 010        LXD C)100,2
01165 +060100222356 010        STO B+1,2
01166 +050000127606 010 123A   CLA DELTAX+1,1
01167 +030000427606 010        FAD DELTAX+1,4
01170 +060100003551 010        STO 1)+1
01171 +050000130201 010        CLA SVPLUS+1,1
01172 +030200130117 010        FSB SVMINU+1,1
01173 +060100003552 010        STO 1)+2
01174 +056000127606 010        LDQ DELTAX+1,1
01175 +026000127606 010        FMP DELTAX+1,1
01176 +060100003553 010        STO 1)+3
01177 +056000003551 010        LDQ 1)+1
01200 +026000003553 010        FMP 1)+3
01201 +024100003157 010        FDP 3)+5
01202 +026000003552 010        FMP 1)+2
01203 +024100003623 010        FDP DF7
01204 +026000003156 010        FMP 3)+4
01205 +060100210546 010        STO C+1,2
01206 +002000001512 010 124A   TRA D)718
01207 -063400403567 010 E)11   SXD C)100,4
01210 -063400203575 010        SXD C)900,2
01211 -063400103574 010        SXD C)202,1
01212 +050000003604 010 125A   CLA M
01213 +040000003145 010        ADD 2)+3
01214 +076000000002 00         CHS
01215 +040000003611 010        ADD J
01216 +010000001220 010 125A1  TZE D)112
01217 +012000001355 010        TPL 132A
01220 -053400103562 010 D)112  LXD C)G0,1
01221 +050000127606 010 126A   CLA DELTAX+1,1
01222 -053400203564 010        LXD C)G2,2
01223 +030000227606 010        FAD DELTAX+1,2
01224 +060100003551 010        STO 1)+1
01225 -053400403565 010        LXD C)G4,4
01226 +050000427606 010        CLA DELTAX+1,4
01227 +030000127606 010        FAD DELTAX+1,1
01230 +013100000000 00         XCA
01231 +026000003551 010        FMP 1)+1
01232 +060100003622 010        STO DF8
01233 +056000003152 010 127A   LDQ 3)
01234 +026000127606 010        FMP DELTAX+1,1
01235 +060100003551 010        STO 1)+1
01236 +076000000002 00         CHS
01237 +030000427606 010        FAD DELTAX+1,4
01240 +030200227606 010        FSB DELTAX+1,2
01241 +013100000000 00         XCA
01242 +026000003152 010        FMP 3)
01243 +013100000000 00         XCA
01244 +026000130117 010        FMP SVMINU+1,1
01245 +060100003553 010        STO 1)+3
01246 +050000427606 010        CLA DELTAX+1,4
```

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01247 +030000003551 010        FAD 1)+1
01250 +030200227606 010        FSB DELTAX+1,2
01251 +013100000000 00         XCA
01252 +026000003152 010        FMP 3)
01253 +013100000000 00         XCA
01254 +026000130201 010        FMP SVPLUS+1,1
01255 +030200003553 010        FSB 1)+3
01256 +024100003622 010        FDP DF8
01257 +026000003156 010        FMP 3)+4
01260 -053400103567 010        LXD C)100,1
01261 +060100127262 010        STO A+1,1
01262 -053400103563 010        LXD C)G1,1
01263 +050000127344 010 128A   CLA XKR+1,1
01264 +010000001512 010 128A1  TZE D)718
01265 +050000227606 010 129A   CLA DELTAX+1,2
01266 +030200427606 010        FSB DELTAX+1,4
01267 +013100000000 00         XCA
01270 +026000003152 010        FMP 3)
01271 +013100000000 00         XCA
01272 -053400103562 010        LXD C)G0,1
01273 +026000127670 010        FMP DELVOL+1,1
01274 +060100003552 010        STO 1)+2
01275 +056000003152 010        LDQ 3)
01276 +026000127606 010        FMP DELTAX+1,1
01277 +060100003553 010        STO 1)+3
01300 +030000227606 010        FAD DELTAX+1,2
01301 +013100000000 00         XCA
01302 +026000130117 010        FMP SVMINU+1,1
01303 +013100000000 00         XCA
01304 +026000427606 010        FMP DELTAX+1,4
01305 +060100003555 010        STO 1)+5
01306 +050000427606 010        CLA DELTAX+1,4
01307 +030000003553 010        FAD 1)+3
01310 +013100000000 00         XCA
01311 +026000130201 010        FMP SVPLUS+1,1
01312 +013100000000 00         XCA
01313 +026000227606 010        FMP DELTAX+1,2
01314 +030200003555 010        FSB 1)+5
01315 +030000003552 010        FAD 1)+2
01316 +024100003622 010        FDP DF8
01317 +026000003156 010        FMP 3)+4
01320 -053400103567 010        LXD C)100,1
01321 +060100122356 010        STO B+1,1
01322 +050200003156 010 130A   CLS 3)+4
01323 +060100003551 010        STO 1)+1
01324 +050000227606 010        CLA DELTAX+1,2
01325 +030200427606 010        FSB DELTAX+1,4
01326 +060100003552 010        STO 1)+2
01327 -053400403562 010        LXD C)G0,4
01330 +050000430201 010        CLA SVPLUS+1,4
01331 +030200430117 010        FSB SVMINU+1,4
01332 +060100003553 010        STO 1)+3
01333 +056000427606 010        LDQ DELTAX+1,4
01334 +026000427606 010        FMP DELTAX+1,4
01335 +060100003554 010        STO 1)+4
01336 +056000003552 010        LDQ 1)+2
01337 +026000003554 010        FMP 1)+4
01340 +024100003157 010        FDP 3)+5
01341 +026000003553 010        FMP 1)+3
01342 +060100003555 010        STO 1)+5
01343 +056000003622 010        LDQ DF8
01344 +026000427670 010        FMP DELVOL+1,4
01345 +030000003555 010        FAD 1)+5
01346 +060100003556 010        STO 1)+6
01347 +056000003551 010        LDQ 1)+1
01350 +026000003156 010        FMP 3)+4
01351 +024100003622 010        FDP DF8
01352 +026000003556 010        FMP 1)+6
01353 +060100110546 010        STO C+1,1
01354 +002000001512 010 131A   TRA D)718
01355 +050000003604 010 132A   CLA M
01356 +040000003142 010        ADD 2)
01357 +076000000002 00         CHS
01360 +040000003611 010        ADD J
01361 +010000001370 010 132A1  TZE D)116
01362 +012000001364 010        TPL 132A2
```

```
01363 +002000001370 010        TRA D)116
01364 -063400201365 010 132A2  SXD 132A3,2
01365 +200000401366 010 132A3  TIX *+1,4
01366 -063400403567 010        SXD C)100,4
01367 +002000002131 010        TRA D)51C
01370 -053400103562 010 D)116  LXD C)G0,1
01371 +050000127606 010 133A   CLA DELTAX+1,1
01372 -053400203564 010        LXD C)G2,2
01373 +030000227606 010        FAD DELTAX+1,2
01374 +060100003551 010        STO 1)+1
01375 +056000003152 010        LDQ 3)
01376 +026000127606 010        FMP DELTAX+1,1
01377 -053400403565 010        LXD C)G4,4
01400 +030000427606 010        FAD DELTAX+1,4
01401 +030000227606 010        FAD DELTAX+1,2
01402 +013100000000 00         XCA
01403 +026000003551 010        FMP 1)+1
01404 +060100003621 010        STO DF9
01405 +050000427606 010 134A   CLA DELTAX+1,4
01406 +030200127606 010        FSB DELTAX+1,1
01407 +013100000000 00         XCA
01410 +026000003152 010        FMP 3)
01411 +013100000000 00         XCA
01412 +026000130117 010        FMP SVMINU+1,1
01413 +060100003552 010        STO 1)+2
01414 +056000003154 010        LDQ 3)+2
01415 +026000127606 010        FMP DELTAX+1,1
01416 +030000427606 010        FAD DELTAX+1,4
01417 +013100000000 00         XCA
01420 +026000003152 010        FMP 3)
01421 +013100000000 00         XCA
01422 +026000130201 010        FMP SVPLUS+1,1
01423 +076000000002 00         CHS
01424 +030000003552 010        FAD 1)+2
01425 +024100003621 010        FDP DF9
01426 +026000003156 010        FMP 3)+4
01427 -053400203567 010        LXD C)100,2
01430 +060100227262 010        STO A+1,2
01431 -053400203563 010        LXD C)G1,2
01432 +050000227344 010 135A   CLA XKR+1,2
01433 +010000001512 010 135A1  TZE D)718
01434 +050000427606 010 136A   CLA DELTAX+1,4
01435 +030000127606 010        FAD DELTAX+1,1
01436 +013100000000 00         XCA
01437 +026000003152 010        FMP 3)
01440 +013100000000 00         XCA
01441 +026000127670 010        FMP DELVOL+1,1
01442 +060100003552 010        STO 1)+2
01443 +056000127606 010        LDQ DELTAX+1,1
01444 +026000130117 010        FMP SVMINU+1,1
01445 +013100000000 00         XCA
01446 +026000427606 010        FMP DELTAX+1,4
01447 +060100003553 010        STO 1)+3
01450 +056000003152 010        LDQ 3)
01451 +026000127606 010        FMP DELTAX+1,1
01452 +030000427606 010        FAD DELTAX+1,4
01453 +013100000000 00         XCA
01454 +026000130201 010        FMP SVPLUS+1,1
01455 +013100000000 00         XCA
01456 +026000127606 010        FMP DELTAX+1,1
01457 +030000003553 010        FAD 1)+3
01460 +030000003552 010        FAD 1)+2
01461 +024100003621 010        FDP DF9
01462 +026000003156 010        FMP 3)+4
01463 -053400203567 010        LXD C)100,2
01464 +060100222356 010        STO B+1,2
01465 +050200003156 010 137A   CLS 3)+4
01466 +060100003551 010        STO 1)+1
01467 +050000427606 010        CLA DELTAX+1,4
01470 +030000127606 010        FAD DELTAX+1,1
01471 +060100003552 010        STO 1)+2
01472 +050000130201 010        CLA SVPLUS+1,1
01473 +030200130117 010        FSB SVMINU+1,1
01474 +060100003553 010        STO 1)+3
01475 +056000127606 010        LDQ DELTAX+1,1
01476 +026000127606 010        FMP DELTAX+1,1
```

```
01473 +060100003554 010        STO 1)+4
01500 +056000003552 010        LDQ 1)+2
01501 +026000003554 010        FMP 1)+4
01502 +024100003157 010        FDP 3)+5
01503 +026000003553 010        FMP 1)+3
01504 +060100003555 010        STO 1)+5
01505 +056000003551 010        LDQ 1)+1
01506 +026000003156 010        FMP 3)+4
01507 +024100003621 010        FDP DF9
01510 +026000003555 010        FMP 1)+5
01511 +060100210546 010        STO C+1,2
01512 -053400403567 010 D)718  LXD C)100,4
01513 -053400203575 010 D)318  LXD C)900,2
01514 -053400103574 010 D)118  LXD C)202,1
                       138A    BSS
01515 +100062401516 010 138A1  TXI *+1,4,50
01516 +100001101517 010        TXI *+1,1,1
01517 -063400103611 010        SXD J,1
01520 +100062201521 010        TXI *+1,2,50
01521 -300000101060 010 138A2  TXL 118A,1
01522 +200000401523 010 138A3  TIX *+1,4
01523 -063400403567 010        SXD C)100,4
01524 +002000002131 010 139A   TRA D)51C
01525 +056000003152 010 140A   LDQ 3)
01526 +026000427607 010        FMP DELTAX+2,4
01527 +030000427610 010        FAD DELTAX+3,4
01530 +030000427606 010        FAD DELTAX+1,4
01531 +060100003551 010        STO 1)+1
01532 +050000427610 010        CLA DELTAX+3,4
01533 +030000427607 010        FAD DELTAX+2,4
01534 +013100000000 00         XCA
01535 +026000003551 010        FMP 1)+1
01536 +060100003626 010        STO DF4
01537 +050000427606 010 241A   CLA DELTAX+1,4
01540 +030200427607 010        FSB DELTAX+2,4
01541 +013100000000 00         XCA
01542 +026000003152 010        FMP 3)
01543 +013100000000 00         XCA
01544 +026000430117 010        FMP SVMINU+1,4
01545 +060100003552 010        STO 1)+2
01546 +056000003154 010        LDQ 3)+2
01547 +026000427606 010        FMP DELTAX+1,4
01550 +030000427607 010        FAD DELTAX+2,4
01551 +013100000000 00         XCA
01552 +026000003152 010        FMP 3)
01553 +013100000000 00         XCA
01554 +026000430201 010        FMP SVPLUS+1,4
01555 +076000000002 00         CHS
01556 +030200003552 010        FSB 1)+2
01557 +024100003626 010        FDP DF4
01560 +026000003156 010        FMP 3)+4
01561 -053400203570 010        LXD C)102,2
01562 +060100227426 010        STO A+101,2
01563 +050000427607 010 142A   CLA DELTAX+2,4
01564 +030000427606 010        FAD DELTAX+1,4
01565 +060100003551 010        STO 1)+1
01566 +050000427610 010        CLA DELTAX+3,4
01567 +030000427607 010        FAD DELTAX+2,4
01570 +013100000000 00         XCA
01571 +026000003551 010        FMP 1)+1
01572 +060100003625 010        STO DF5
01573 +056000003152 010 143A   LDQ 3)
01574 +026000427607 010        FMP DELTAX+2,4
01575 +060100003551 010        STO 1)+1
01576 +076000000002 00         CHS
01577 +030000427606 010        FAD DELTAX+1,4
01600 +030200427610 010        FSB DELTAX+3,4
01601 +013100000000 00         XCA
01602 +026000003152 010        FMP 3)
01603 +013100000000 00         XCA
01604 +026000430117 010        FMP SVMINU+1,4
01605 +060100003553 010        STO 1)+3
01606 +056000003154 010        LDQ 3)+2
01607 +026000427606 010        FMP DELTAX+1,4
01610 +030000003551 010        FAD 1)+1
01611 +030000427610 010        FAD DELTAX+3,4
```

```
01612 +013100000000 00          XCA
01613 +026000003152 010         FMP 3)
01614 +013100000000 00          XCA
01615 +026000430201 010         FMP SVPLUS+1,4
01616 +030000003553 010         FAD 1)+3
01617 +024100003625 010         FDP DF5
01620 +026000003156 010         FMP 3)+4
01621 +060100227344 010         STO A+51,2
01622 +050000427607 010 144A    CLA DELTAX+2,4
01623 +030000427606 010         FAD DELTAX+1,4
01624 +060100003551 010         STO 1)+1
01625 +056000003152 010         LDQ 3)
01626 +026000427607 010         FMP DELTAX+2,4
01627 +030000427610 010         FAD DELTAX+3,4
01630 +030000427606 010         FAD DELTAX+1,4
01631 +013100000000 00          XCA
01632 +026000003551 010         FMP 1)+1
01633 +060100003624 010         STO DF6
01634 +056000003154 010 145A    LDQ 3)+2
01635 +026000427607 010         FMP DELTAX+2,4
01636 +060100003551 010         STO 1)+1
01637 +030000427610 010         FAD DELTAX+3,4
01640 +013100000000 00          XCA
01641 +026000003152 010         FMP 3)
01642 +013100000000 00          XCA
01643 +026000430117 010         FMP SVMINU+1,4
01644 +060100003553 010         STO 1)+3
01645 +056000003155 010         LDQ 3)+3
01646 +026000427606 010         FMP DELTAX+1,4
01647 +030000003551 010         FAD 1)+1
01650 +030000427610 010         FAD DELTAX+3,4
01651 +013100000000 00          XCA
01652 +026000003152 010         FMP 3)
01653 +013100000000 00          XCA
01654 +026000430201 010         FMP SVPLUS+1,4
01655 +076000000002 00          CHS
01656 +030000003553 010         FAD 1)+3
01657 +024100003624 010         FDP DF6
01660 +026000003156 010         FMP 3)+4
01661 +060100227262 010         STO A+1,2
01662 -053400103563 010         LXD C)G1,1
01663 +050000127344 010 146A    CLA XKR+1,1
01664 +010000002132 010 146A1   TZE D)11C
01665 +050000427606 010 147A    CLA DELTAX+1,4
01666 +030000427607 010         FAD DELTAX+2,4
01667 +013100000000 00          XCA
01670 +026000003152 010         FMP 3)
01671 +013100000000 00          XCA
01672 +026000427670 010         FMP DELVOL+1,4
01673 +060100003552 010         STO 1)+2
01674 +056000427607 010         LDQ DELTAX+2,4
01675 +026000430117 010         FMP SVMINU+1,4
01676 +013100000000 00          XCA
01677 +026000427606 010         FMP DELTAX+1,4
01700 +060100003553 010         STO 1)+3
01701 +056000003152 010         LDQ 3)
01702 +026000427606 010         FMP DELTAX+1,4
01703 +030000427607 010         FAD DELTAX+2,4
01704 +013100000000 00          XCA
01705 +026000430201 010         FMP SVPLUS+1,4
01706 +013100000000 00          XCA
01707 +026000427606 010         FMP DELTAX+1,4
01710 +030000003553 010         FAD 1)+3
01711 +030000003552 010         FAD 1)+2
01712 +024100003626 010         FDP DF4
01713 +026000003156 010         FMP 3)+4
01714 +060100222522 010         STO B+101,2
01715 +056000003152 010 148A    LDQ 3)
01716 +026000427607 010         FMP DELTAX+2,4
01717 +060100003551 010         STO 1)+1
01720 +030000427606 010         FAD DELTAX+1,4
01721 +030000427610 010         FAD DELTAX+3,4
01722 +013100000000 00          XCA
01723 +026000003152 010         FMP 3)
01724 +013100000000 00          XCA
01725 +026000427670 010         FMP DELVOL+1,4
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01726 +060100003553 010        STO 1)+3
01727 +050000003551 010        CLA 1)+1
01730 +030000427610 010        FAD DELTAX+3,4
01731 +013100000000 00         XCA
01732 -053400103562 010        LXD C)G0,1
01733 +026000130117 010        FMP SVMINU+1,1
01734 +013100000000 00         XCA
01735 +026000427606 010        FMP DELTAX+1,4
01736 +060100003555 010        STO 1)+5
01737 +056000003152 010        LDQ 3)
01740 +026000427606 010        FMP DELTAX+1,4
01741 +030000003551 010        FAD 1)+1
01742 +030000427610 010        FAD DELTAX+3,4
01743 +013100000000 00         XCA
01744 +026000430201 010        FMP SVPLUS+1,4
01745 +013100000000 00         XCA
01746 +026000427606 010        FMP DELTAX+1,4
01747 +030000003555 010        FAD 1)+5
01750 +030000003553 010        FAD 1)+3
01751 +024100003625 010        FDP DF5
01752 +026000003156 010        FMP 3)+4
01753 +076000000002 00         CHS
01754 +060100222440 010        STO B+51,2
01755 +056000003154 010 149A   LDQ 3)+2
01756 +026000427607 010        FMP DELTAX+2,4
01757 +060100003551 010        STO 1)+1
01760 +056000003152 010        LDQ 3)
01761 +026000427606 010        FMP DELTAX+1,4
01762 +060100003552 010        STO 1)+2
01763 +030000003551 010        FAD 1)+1
01764 +030000427610 010        FAD DELTAX+3,4
01765 +013100000000 00         XCA
01766 +026000003152 010        FMP 3)
01767 +013100000000 00         XCA
01770 +026000427670 010        FMP DELVOL+1,4
01771 +060100003554 010        STO 1)+4
01772 +056000003152 010        LDQ 3)
01773 +026000427607 010        FMP DELTAX+2,4
01774 +060100003555 010        STO 1)+5
01775 +030000427610 010        FAD DELTAX+3,4
01776 +013100000000 00         XCA
01777 +026000430117 010        FMP SVMINU+1,4
02000 +013100000000 00         XCA
02001 +026000427607 010        FMP DELTAX+2,4
02002 +060100003557 010        STO 1)+7
02003 +050000003552 010        CLA 1)+2
02004 +030000003555 010        FAD 1)+5
02005 +030000427610 010        FAD DELTAX+3,4
02006 +060100003560 010        STO 1)+8
02007 +050000003552 010        CLA 1)+2
02010 +030000427607 010        FAD DELTAX+2,4
02011 +060100003561 010        STO 1)+9
02012 +056000003560 010        LDQ 1)+8
02013 +026000430201 010        FMP SVPLUS+1,4
02014 +013100000000 00         XCA
02015 +026000003561 010        FMP 1)+9
02016 +030200003557 010        FSB 1)+7
02017 +030000003554 010        FAD 1)+4
02020 +024100003624 010        FDP DF6
02021 +026000003156 010        FMP 3)+4
02022 +060100222356 010        STO B+1,2
02023 +050200003156 010 150A   CLS 3)+4
02024 +060100003551 010        STO 1)+1
02025 +050000427606 010        CLA DELTAX+1,4
02026 +030000427607 010        FAD DELTAX+2,4
02027 +060100003552 010        STO 1)+2
02030 +050000430201 010        CLA SVPLUS+1,4
02031 +030200430117 010        FSB SVMINU+1,4
02032 +060100003553 010        STO 1)+3
02033 +056000427606 010        LDQ DELTAX+1,4
02034 +026000427606 010        FMP DELTAX+1,4
02035 +060100003554 010        STO 1)+4
02036 +056000003552 010        LDQ 1)+2
02037 +026000003554 010        FMP 1)+4
02040 +024100003157 010        FDP 3)+5
02041 +026000003553 010        FMP 1)+3
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02042 +060100003555 010        STO 1)+5
02043 +056000003551 010        LDQ 1)+1
02044 +026000003156 010        FMP 3)+4
02045 +024100003626 010        FDP DF4
02046 +026000003555 010        FMP 1)+5
02047 +060100210712 010        STO C+101,2
02050 +056000003152 010 151A   LDQ 3)
02051 +026000427607 010        FMP DELTAX+2,4
02052 +030000427606 010        FAD DELTAX+1,4
02053 +030000427610 010        FAD DELTAX+3,4
02054 +060100003551 010        STO 1)+1
02055 +050000430201 010        CLA SVPLUS+1,4
02056 +030200430117 010        FSB SVMINU+1,4
02057 +060100003552 010        STO 1)+2
02060 +056000427606 010        LDQ DELTAX+1,4
02061 +026000427606 010        FMP DELTAX+1,4
02062 +060100003553 010        STO 1)+3
02063 +056000003551 010        LDQ 1)+1
02064 +026000003553 010        FMP 1)+3
02065 +024100003157 010        FDP 3)+5
02066 +026000003552 010        FMP 1)+2
02067 +024100003625 010        FDP DF5
02070 +026000003156 010        FMP 3)+4
02071 +060100210630 010        STO C+51,2
02072 +050200003156 010 152A   CLS 3)+4
02073 +060100003551 010        STO 1)+1
02074 +056000003154 010        LDQ 3)+2
02075 +026000427607 010        FMP DELTAX+2,4
02076 +060100003552 010        STO 1)+2
02077 +056000003152 010        LDQ 3)
02100 +026000427606 010        FMP DELTAX+1,4
02101 +030000003552 010        FAD 1)+2
02102 +030000427610 010        FAD DELTAX+3,4
02103 +060100003553 010        STO 1)+3
02104 +050000430201 010        CLA SVPLUS+1,4
02105 +030200430117 010        FSB SVMINU+1,4
02106 +060100003554 010        STO 1)+4
02107 +056000427606 010        LDQ DELTAX+1,4

02110 +026000427606 010        FMP DELTAX+1,4
02111 +060100003555 010        STO 1)+5
02112 +056000003553 010        LDQ 1)+3
02113 +026000003555 010        FMP 1)+5
02114 +024100003157 010        FDP 3)+5
02115 +026000003554 010        FMP 1)+4
02116 +060100003556 010        STO 1)+6
02117 +056000003624 010        LDQ DF6
02120 +026000427670 010        FMP DELVOL+1,4
02121 +030000003556 010        FAD 1)+6
02122 +060100003557 010        STO 1)+7
02123 +056000003551 010        LDQ 1)+1
02124 +026000003156 010        FMP 3)+4
02125 +024100003624 010        FDP DF6
02126 +026000003557 010        FMP 1)+7
02127 +060100210546 010        STO C+1,2
02130 +002000002133 010        TRA 153A
02131 -053400403566 010 D)51C  LXD C)G5,4
02132 -053400103562 010 D)11C  LXD C)G0,1
                        153A   BSS
02133 -053400203567 010        LXD C)100,2
02134 +100001202135 010 153A1  TXI *+1,2,1
02135 -063400203567 010        SXD C)100,2
02136 +100001102137 010        TXI *+1,1,1
02137 -063400103562 010        SXD C)G0,1
02140 -063400103617 010        SXD I,1
02141 -300000100433 010 153A2  TXL 99A,1
02142 -050000003601 010 154A   CAL N3
02143 -063400403170 010        SXD 6)+4,4
02144 +007400400004 010        TSX (STH),4
02145 +000000003357 010        PZE 8)2M
02146 -053400403170 010        LXD 6)+4,4
02147 -053400203563 010        LXD C)G1,2
02150 +056000227344 010 155A   LDQ XKR+1,2
02151 -100000000000 00         STR
02152 +056000003613 010        LDQ J1
02153 -100000000000 00         STR
02154 -063400403170 010        SXD 6)+4,4
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02155 +007400400005 010        TSX (FIL),4
02156 -053400403170 010        LXD 6)+4,4
02157 +050000003613 010 156A   CLA J1
02160 +040000003145 010        ADD 2)+3
02161 +060100003613 010        STO J1
02162 -050000003601 010 157A   CAL N3
02163 -063400403170 010        SXD 6)+4,4
02164 +007400400004 010        TSX (STH),4
02165 +000000003354 010        PZE 8)12
02166 -053400403170 010        LXD 6)+4,4
02167 +056000003614 010 158A   LDQ IX
02170 -100000000000 00         STR
02171 +056000003613 010        LDQ J1
02172 -100000000000 00         STR
02173 -063400403170 010        SXD 6)+4,4
02174 +007400400005 010        TSX (FIL),4
02175 -053400403170 010        LXD 6)+4,4
02176 +050000003613 010 159A   CLA J1
02177 +040000003145 010        ADD 2)+3
02200 +060100003613 010        STO J1
02201 +050000003152 010 160A   CLA 3)
02202 +024100003577 010        FDP SREF
02203 -060000003632 010        STQ COEFZ
02204 +050000227344 010 161A   CLA XKR+1,2
02205 +010000002207 010 161A1  TZE 162A
02206 +012000002621 010        TPL 219A
02207 -053400103145 010 162A   LXD 2)+3,1
02210 +050000003614 010        CLA IX
02211 +062200002233 010        STD 164A4
02212 +056000003614 010        LDQ IX
02213 +020000003147 010        MPY 2)+5
02214 +076700000021 00         ALS 17
02215 +062200002230 010        STD 164A2
02216 +056000003614 010        LDQ IX
02217 +020000003147 010        MPY 2)+5
02220 +076700000021 00         ALS 17
02221 +062200002231 010        STD 164A3
                         163A  BSS
02222 +056000127262 010 164A   LDQ A+1,1
02223 +026000003632 010        FMP COEFZ
02224 +013100000000 00         XCA
02225 +026000003640 010        FMP CBAR
02226 +060100127262 010        STO A+1,1
02227 +100062102230 010 164A1  TXI *+1,1,50
02230 -300000102222 010 164A2  TXL 164A,1
02231 +200000102232 010 164A3  TIX *+1,1
02232 +100001102233 010        TXI *+1,1,1
02233 -300000102222 010 164A4  TXL 163A,1
02234 +050000227344 010 165A   CLA XKR+1,2
02235 +010000002435 010 165A1  TZE 193A
02236 -053400103145 010 166A   LXD 2)+3,1
02237 +050000003614 010        CLA IX
02240 +062200002264 010        STD 170A4
02241 +056000003614 010        LDQ IX
02242 +020000003147 010        MPY 2)+5
02243 +076700000021 00         ALS 17
02244 +062200002261 010        STD 170A2
02245 +056000003614 010        LDQ IX
02246 +020000003147 010        MPY 2)+5
02247 +076700000021 00         ALS 17
02250 +062200002262 010        STD 170A3
                         167A  BSS
02251 +050000003632 010 168A   CLA COEFZ
02252 +024100003640 010        FDP CBAR
02253 +026000110546 010        FMP C+1,1
02254 +060100110546 010        STO C+1,1
02255 +056000003632 010 169A   LDQ COEFZ
02256 +026000122356 010        FMP B+1,1
02257 +060100122356 010        STO B+1,1
                         170A  BSS
02260 +100062102261 010 170A1  TXI *+1,1,50
02261 -300000102251 010 170A2  TXL 168A,1
02262 +200000102263 010 170A3  TIX *+1,1
02263 +100001102264 010        TXI *+1,1,1
02264 -300000102251 010 170A4  TXL 167A,1
02265 +050000227344 010 171A   CLA XKR+1,2
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02266 +010000002435 010 171A1  TZE 193A
02267 +012000002621 010        TPL 219A
02270 -050000003602 010 172A   CAL N2
02271 +007400400004 010        TSX (STH),4
02272 +000000003513 010        PZE 8)PE
02273 +007400400005 010        TSX (FIL),4
02274 -050000003602 010 173A   CAL N2
02275 +007400400004 010        TSX (STH),4
02276 +000000003351 010        PZE 8)2E
02277 +056000227344 010 174A   LDQ XKR+1,2
02300 -100000000000 00         STR
02301 +056000003614 010        LDQ IX
02302 -100000000000 00         STR
02303 +007400400005 010        TSX (FIL),4
02304 -050000003602 010 175A   CAL N2
02305 +007400400004 010        TSX (STH),4
02306 +000000003322 010        PZE 8)PK
02307 +007400400005 010        TSX (FIL),4
                       176A    BSS
02310 +007400400006 010 177A   TSX MPRINT,4
02311 +007400027261 010        TSX A
02312 +007400003614 010        TSX IX
02313 +007400003614 010        TSX IX
02314 +007400003147 010        TSX 2)+5
02315 +007400003602 010        TSX N2
02316 +007400403110 010        TSX A)102,4
02317 -053400103570 010        LXD C)102,1
02320 -053400403614 010        LXD IX,4
02321 -053400403614 010        LXD IX,4
02322 +050000003620 010 178A   CLA IPUNCH
02323 +010000002326 010 178A1  TZE 179A
02324 +012000002361 010        TPL E)1T
02325 +002000002361 010        TRA E)1T
02326 +050000003613 010 179A   CLA J1
02327 +040200003142 010        SUB 2)
02330 +010000002333 010 179A1  TZE E)1Q
02331 +012000002337 010        TPL 182A
02332 +002000002337 010        TRA 182A
02333 -063400403566 010 E)1Q   SXD C)G5,4
02334 +050000003612 010 180A   CLA J2
02335 +060100003613 010        STO J1
02336 +002000002342 010 181A   TRA 183A
02337 +050000003612 010 182A   CLA J2
02340 +040000003145 010        ADD 2)+3
02341 +060100003613 010        STO J1
02342 +050000003614 010 183A   CLA IX
02343 +076500000043 00         LRS 35
02344 +022100003150 010        DVP 2)+6
02345 +076000000000 00         CLM
02346 +076300000022 00         LLS 18
02347 -060000003551 010        STQ 1)+1
02350 +050000003614 010        CLA IX
02351 +040000003551 010        ADD 1)+1
02352 +013100000000 00         XCA
02353 +020000003143 010        MPY 2)+1
02354 +076700000021 00         ALS 17
02355 +040000003613 010        ADD J1
02356 +040000003151 010        ADD 2)+7
02357 +060100003612 010        STO J2
02360 +002000002362 010        TRA 184A
02361 -063400403566 010 E)1T   SXD C)G5,4
02362 -050000003602 010 184A   CAL N2
02363 +007400400004 010        TSX (STH),4
02364 +000000003315 010        PZE 8)22
02365 +007400400005 010        TSX (FIL),4
                       185A    BSS
02366 +007400400006 010 186A   TSX MPRINT,4
02367 +007400022355 010        TSX B
02370 +007400003614 010        TSX IX
02371 +007400003614 010        TSX IX
02372 +007400003147 010        TSX 2)+5
02373 +007400003602 010        TSX N2
02374 +007400403110 010        TSX A)102,4
02375 -053400103570 010        LXD C)102,1
02376 -053400403614 010        LXD IX,4
02377 -053400403614 010        LXD IX,4
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02400 -050000003602 010 187A   CAL N2
02401 -063400403170 010        SXD 6)+4,4
02402 +007400400004 010        TSX (STH),4
02403 +000000003307 010        PZE 8)23
02404 +007400400005 010        TSX (FIL),4
02405 +007400400006 010 189A   TSX MPRINT,4
02406 +007400010545 010        TSX C
02407 +007400003614 010        TSX IX
02410 +007400003614 010        TSX IX
02411 +007400003147 010        TSX 2)+5
02412 +007400003602 010        TSX N2
02413 +007400403110 010        TSX A)102,4
02414 -053400103570 010        LXD C)102,1
02415 -053400403170 010        LXD 6)+4,4
02416 -053400403614 010        LXD IX,4
02417 -053400403614 010        LXD IX,4
02420 -050000003602 010 190A   CAL N2
02421 -063400403170 010        SXD 6)+4,4
02422 +007400400004 010        TSX (STH),4
02423 +000000003257 010        PZE 8)75
02424 -053400403170 010        LXD 6)+4,4
02425 +056000003613 010 191A   LDQ J1
02426 -100000000000 00         STR
02427 +056000003612 010        LDQ J2
02430 -100000000000 00         STR
02431 -063400403170 010        SXD 6)+4,4
02432 +007400400005 010        TSX (FIL),4
02433 -053400403170 010        LXD 6)+4,4
02434 +002000002532 010 192A   TRA 206A
02435 -050000003602 010 193A   CAL N2
02436 +007400400004 010        TSX (STH),4
02437 +000000003513 010        PZE 8)PE
02440 +007400400005 010        TSX (FIL),4
02441 -050000003602 010 194A   CAL N2
02442 +007400400004 010        TSX (STH),4
02443 +000000003302 010        PZE 8)28
02444 +056000227344 010 195A   LDQ XKR+1,2
02445 -100000000000 00         STR
02446 +056000003614 010        LDQ IX
02447 -100000000000 00         STR
02450 +007400400005 010        TSX (FIL),4
                          196A BSS
02451 +007400400006 010 197A   TSX MPRINT,4
02452 +007400027261 010        TSX A
02453 +007400003614 010        TSX IX
02454 +007400003614 010        TSX IX
02455 +007400003147 010        TSX 2)+5
02456 +007400003602 010        TSX N2
02457 +007400403110 010        TSX A)102,4
02460 -053400103570 010        LXD C)102,1
02461 -053400403614 010        LXD IX,4
02462 -053400403614 010        LXD IX,4
02463 -063400403566 010        SXD C)G5,4
02464 +050000003620 010 198A   CLA IPUNCH
02465 +010000002470 010 198A1  TZE 199A
02466 +012000003074 010        TPL D)32E
02467 +002000003074 010        TRA D)32E
02470 +050000003613 010 199A   CLA J1
02471 +040200003142 010        SUB 2)
02472 +010000002475 010 199A1  TZE 200A
02473 +012000002500 010        TPL 202A
02474 +002000002500 010        TRA 202A
02475 +050000003612 010 200A   CLA J2
02476 +060100003613 010        STO J1
02477 +002000002503 010 201A   TRA 203A
02500 +050000003612 010 202A   CLA J2
02501 +040000003145 010        ADD 2)+3
02502 +060100003613 010        STO J1
02503 +050000003614 010 203A   CLA IX
02504 +076500000043 00         LRS 35
02505 +022100003150 010        DVP 2)+6
02506 +076000000000 00         CLM
02507 +076300000022 00         LLS 18
02510 +020000003614 010        MPY IX
02511 +076700000021 00         ALS 17
02512 +040000003614 010        ADD IX
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02513 +040000003613 010        ADD J1
02514 +040000003142 010        ADD 2)
02515 +060100003612 010        STO J2
02516 -050000003602 010 204A   CAL N2
02517 -063400403170 010        SXD 6)+4,4
02520 +007400400004 010        TSX (STH),4
02521 +000000003257 010        PZE 8)75
02522 -053400403170 010        LXD 6)+4,4
02523 +056000003613 010 205A   LDQ J1
02524 -100000000000 00         STR
02525 +056000003612 010        LDQ J2
02526 -100000000000 00         STR
02527 -063400403170 010        SXD 6)+4,4
02530 +007400400005 010        TSX (FIL),4
02531 -053400403170 010        LXD 6)+4,4
                       206A    BSS
02532 -050000003160 010 207A   CAL 3)+6
02533 +060200003634 010        SLW CHS
                       208A    BSS
02534 +007400400007 010 209A   TSX MPUNCH,4
02535 +007400027261 010        TSX A
02536 +007400003614 010        TSX IX
02537 +007400003614 010        TSX IX
02540 +007400003146 010        TSX 2)+4
02541 +007400003146 010        TSX 2)+4
02542 +007400003145 010        TSX 2)+3
02543 +007400003634 010        TSX CHS
02544 +007400003147 010        TSX 2)+5
02545 +007400003601 010        TSX N3
02546 +007400403110 010        TSX A)102,4
02547 -053400103570 010        LXD C)102,1
02550 -053400403614 010        LXD IX,4
02551 -053400403614 010        LXD IX,4
02552 -063400403566 010        SXD C)G5,4
02553 +050000227344 010 210A   CLA XKR+1,2
02554 +010000003074 010 210A1  TZE D)32E
                       211A    BSS
02555 -050000003161 010 212A   CAL 3)+7
02556 +060200003637 010        SLW CHD
02557 -050000003162 010 213A   CAL 3)+8
02560 +060200003636 010        SLW CHI
                       214A    BSS
02561 +007400400007 010 215A   TSX MPUNCH,4
02562 +007400022355 010        TSX B
02563 +007400003614 010        TSX IX
02564 +007400003614 010        TSX IX
02565 +007400003146 010        TSX 2)+4
02566 +007400003146 010        TSX 2)+4
02567 +007400003145 010        TSX 2)+3
02570 +007400003637 010        TSX CHD
02571 +007400003147 010        TSX 2)+5
02572 +007400003601 010        TSX N3
02573 +007400403110 010        TSX A)102,4
02574 -053400103570 010        LXD C)102,1
02575 -053400403614 010        LXD IX,4
02576 -053400403614 010        LXD IX,4
02577 -063400403170 010 216A   SXD 6)+4,4
02600 +007400400007 010 217A   TSX MPUNCH,4
02601 +007400010545 010        TSX C
02602 +007400003614 010        TSX IX
02603 +007400003614 010        TSX IX
02604 +007400003146 010        TSX 2)+4
02605 +007400003146 010        TSX 2)+4
02606 +007400003145 010        TSX 2)+3
02607 +007400003636 010        TSX CHI
02610 +007400003147 010        TSX 2)+5
02611 +007400003601 010        TSX N3
02612 +007400403110 010        TSX A)102,4
02613 -053400103570 010        LXD C)102,1
02614 -053400403170 010        LXD 6)+4,4
02615 -053400403614 010        LXD IX,4
02616 -053400403614 010        LXD IX,4
02617 -063400403566 010        SXD C)G5,4
02620 +002000003074 010 218A   TRA D)32E
02621 -050000003602 010 219A   CAL N2
02622 +007400400004 010        TSX (STH),4
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02623 +000000003513 010        PZE 8)PE
02624 +007400400005 010        TSX (FIL),4
02625 -050000003602 010 220A   CAL N2
02626 +007400400004 010        TSX (STH),4
02627 +000000003242 010        PZE 8)2L
02630 +056000227344 010 221A   LDQ XKR+1,2
02631 -100000000000 00         STR
02632 +056000003614 010        LDQ IX
02633 -100000000000 00         STR
02634 +007400400005 010        TSX (FIL),4
02635 -050000003602 010 222A   CAL N2
02636 +007400400004 010        TSX (STH),4
02637 +000000003213 010        PZE 8)SN
02640 +007400400005 010        TSX (FIL),4
02641 +056000003142 010 223A   LDQ 2)
02642 +020000003614 010        MPY IX
02643 +076700000021 00         ALS 17
02644 +060100003615 010        STO IX2
02645 -053400103145 010 224A   LXD 2)+3,1
02646 -063400103567 010        SXD C)100,1
02647 +050000003615 010        CLA IX2
02650 +040200003145 010        SUB 2)+3
02651 +040000003142 010        ADD 2)
02652 +076500000043 00         LRS 35
02653 +022100003142 010        DVP 2)
02654 +020000003142 010        MPY 2)
02655 +076500000022 00         LRS 18
02656 +020000003147 010        MPY 2)+5
02657 +076300000043 00         LLS 35
02660 +062200002757 010        STD 229A3
02661 +050000003167 010        CLA 6)+3
02662 +060100003553 010        STO 1)+3
02663 +056000003606 010        LDQ KZ
02664 +020000003147 010        MPY 2)+5
02665 +076700000021 00         ALS 17
02666 +040200003147 010        SUB 2)+5
02667 +040000003553 010        ADD 1)+3
02670 +060100003553 010        STO 1)+3
02671 -053400403553 010        LXD 1)+3,4
02672 -063400403571 010        SXD C)103,4
02673 -053400403145 010        LXD 2)+3,4
02674 -063400403573 010        SXD C)201,4
02675 +050000003614 010        CLA IX
02676 +062200002770 010        STD 229A4
02677 -075400400000 00         PXD 0,4
02700 +060100003617 010        STO I
02701 -053400103563 010 D)526  LXD C)G1,1
02702 -053400403567 010 D)426  LXD C)100,4
02703 -053400203145 010 225A   LXD 2)+3,2
02704 -063400203572 010        SXD C)200,2
02705 +050000003615 010        CLA IX2
02706 +062200002756 010        STD 229A2
02707 -075400200000 00         PXD 0,2
02710 +060100003611 010        STO J
02711 +050000003611 010 226A   CLA J
02712 +076500000043 00         LRS 35
02713 +022100003142 010        DVP 2)
02714 +076000000000 00         CLM
02715 +076300000022 00         LLS 18
02716 +013100000000 00         XCA
02717 +040000003145 010        ADD 2)+3
02720 +060100003606 010        STO KZ
02721 -063400403170 010        SXD 6)+4,4
02722 +007400403125 010        TSX A)103,4
02723 -053400203571 010        LXD C)103,2
02724 -053400403170 010        LXD 6)+4,4
02725 +056000003641 010 227A   LDQ BR
02726 +026000003641 010        FMP BR
02727 +013100000000 00         XCA
02730 +026000003576 010        FMP S
02731 +060100003552 010        STO 1)+2
02732 +050000003156 010        CLA 3)+4
02733 +024100003552 010        FDP 1)+2
02734 +026000210546 010        FMP C+1,2
02735 +060100003553 010        STO 1)+3
02736 +056000003633 010        LDQ COEFA
```

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02737 +026000227262 010        FMP A+1,2
02740 +030200003553 010        FSB 1)+3
02741 +060100415452 010        STO CH+1,4
02742 +056000003641 010 228A   LDQ BR
02743 +026000003576 010        FMP S
02744 +060100003551 010        STO 1)+1
02745 +050000127344 010        CLA XKR+1,1
02746 +024100003551 010        FDP 1)+1
02747 +026000222356 010        FMP B+1,2
02750 +060100415370 010        STO CH-49,4
                       229A    BSS
02751 +100144402752 010 229A1  TXI *+1,4,100
02752 -053400203572 010        LXD C)200,2
02753 +100002202754 010        TXI *+1,2,2
02754 -063400203572 010        SXD C)200,2
02755 -063400203611 010        SXD J,2
02756 -300000202711 010 229A2  TXL 226A,2
02757 +200000402760 010 229A3  TIX *+1,4
02760 +100001402761 010        TXI *+1,4,1
02761 -053400203571 010        LXD C)103,2
02762 +100001202763 010        TXI *+1,2,1
02763 -063400203571 010        SXD C)103,2
02764 -053400203573 010        LXD C)201,2
02765 +100001202766 010        TXI *+1,2,1
02766 -063400203573 010        SXD C)201,2
02767 -063400203617 010        SXD I,2
02770 -300000202703 010 229A4  TXL 225A,2
                       230A    BSS
02771 +007400400006 010 231A   TSX MPRINT,4
02772 +007400015451 010        TSX CH
02773 +007400003614 010        TSX IX
02774 +007400003615 010        TSX IX2
02775 +007400003147 010        TSX 2)+5
02776 +007400003602 010        TSX N2
02777 +007400403110 010        TSX A)102,4
03000 -053400203570 010        LXD C)102,2
03001 -053400403614 010        LXD IX,4
03002 +050000003620 010 232A   CLA IPUNCH
03003 +010000003006 010 232A1  TZE 233A
03004 +012000003077 010        TPL E)12E
03005 +002000003077 010        TRA E)12E
                       233A    BSS
03006 -050000003163 010 234A   CAL 3)+9
03007 +060200003635 010        SLW CHM
                       235A    BSS
03010 +007400400007 010 236A   TSX MPUNCH,4
03011 +007400015451 010        TSX CH
03012 +007400003614 010        TSX IX
03013 +007400003615 010        TSX IX2
03014 +007400003146 010        TSX 2)+4
03015 +007400003146 010        TSX 2)+4
03016 +007400003145 010        TSX 2)+3
03017 +007400003635 010        TSX CHM
03020 +007400003147 010        TSX 2)+5
03021 +007400003601 010        TSX N3
03022 +007400403110 010        TSX A)102,4
03023 -053400203570 010        LXD C)102,2
03024 -053400403614 010        LXD IX,4
03025 -063400403566 010        SXD C)G5,4
03026 +050000003613 010 237A   CLA J1
03027 +040200003142 010        SUB 2)
03030 +010000003033 010 237A1  TZE 238A
03031 +012000003036 010        TPL 240A
03032 +002000003036 010        TRA 240A
03033 +050000003612 010 238A   CLA J2
03034 +060100003613 010        STO J1
03035 +002000003041 010 239A   TRA 241A
03036 +050000003612 010 240A   CLA J2
03037 +040000003145 010        ADD 2)+3
03040 +060100003613 010        STO J1
03041 +050000003614 010 241A   CLA IX
03042 +076500000043 00         LRS 35
03043 +022100003150 010        DVP 2)+6
03044 +076000000000 00         CLM
03045 +076300000022 00         LLS 18
03046 -060000003551 010        STQ 1)+1
```

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03047 +050000003614 010        CLA IX
03050 +040000003551 010        ADD 1)+1
03051 +013100000000 00         XCA
03052 +020000003142 010        MPY 2)
03053 +076700000021 00         ALS 17
03054 +040000003142 010        ADD 2)
03055 +040000003613 010        ADD J1
03056 +060100003612 010        STO J2
03057 -050000003602 010 242A   CAL N2
03060 -063400403170 010        SXD 6)+4,4
03061 +007400400004 010        TSX (STH),4
03062 +000000003257 010        PZE 8)75
03063 -053400403170 010        LXD 6)+4,4
03064 +056000003613 010 243A   LDQ J1
03065 -100000000000 00         STR
03066 +056000003612 010        LDQ J2
03067 -100000000000 00         STR
03070 -063400403170 010        SXD 6)+4,4
03071 +007400400005 010        TSX (FIL),4
03072 -053400403170 010        LXD 6)+4,4
03073 +002000003100 010        TRA 244A
03074 -053400103563 010 D)32E  LXD C)G1,1
03075 -053400203570 010 D)22E  LXD C)102,2
03076 +002000003100 010        TRA 244A
03077 -063400403566 010 E)12E  SXD C)G5,4
                        244A   BSS
03100 +100001103101 010 244A1  TXI *+1,1,1
03101 -063400103563 010        SXD C)G1,1
03102 -300000100407 010 244A2  TXL 96A,1
03103 -050000003601 010 245A   CAL N3
03104 -063400403170 010        SXD 6)+4,4
03105 +007400400010 010        TSX (EFT),4
03106 -053400403170 010        LXD 6)+4,4
03107 +002000000020 010 246A   TRA 25A
03110 +050000003167 010 A)102  CLA 6)+3
03111 +060100003553 010        STO 1)+3
03112 +050000003614 010        CLA IX
03113 +040200003167 010        SUB 6)+3
03114 +040000003553 010        ADD 1)+3
03115 +060100003553 010        STO 1)+3
03116 +056000003614 010        LDQ IX
03117 +020000003147 010        MPY 2)+5
03120 +076700000021 00         ALS 17
03121 +040200003147 010        SUB 2)+5
03122 +040000003553 010        ADD 1)+3
03123 +060100003570 010        STO C)102
03124 +002000400001 00         TRA 1,4
03125 +050000003167 010 A)103  CLA 6)+3
03126 +060100003553 010        STO 1)+3
03127 +050000003617 010        CLA I
03130 +040200003167 010        SUB 6)+3
03131 +040000003553 010        ADD 1)+3
03132 +060100003553 010        STO 1)+3
03133 +056000003606 010        LDQ KZ
03134 +020000003147 010        MPY 2)+5
03135 +076700000021 00         ALS 17
03136 +040200003147 010        SUB 2)+5
03137 +040000003553 010        ADD 1)+3
03140 +060100003571 010        STO C)103
03141 +002000400001 00         TRA 1,4
03142 +000002000000 00  2)     OCT +000002000000
03143 +000003000000 00         OCT +000003000000
03144 +000005000000 00         OCT +000005000000
03145 +000001000000 00         OCT +000001000000
03146 +000000000000 00         OCT +000000000000
03147 +000062000000 00         OCT +000062000000
03150 +000026000000 00         OCT +000026000000
03151 +000004000000 00         OCT +000004000000
03152 +202400000000 00  3)     OCT +202400000000
03153 +000000000000 00         OCT +000000000000
03154 +202600000000 00         OCT +202600000000
03155 +203400000000 00         OCT +203400000000
03156 +201400000000 00         OCT +201400000000
03157 +203600000000 00         OCT +203600000000
03160 -206060233062 00         OCT -206060233062
03161 -206060233024 00         OCT -206060233024
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03162 -206060233031 00          OCT -206060233031
03163 -206060233044 00          OCT -206060233044
03164 +233000000000 00  8)      OCT +233000000000
03165 +000000377777 00          OCT +000000377777
03166 +000000000000 00          OCT +000000000000
03167 +000001000000 00          OCT +000001000000
03170 +000000000000 00          OCT +000000000000
03171 +000000000000 00          OCT +000000000000
03172 -213460606060 00          BCD 1/)
03173 -052151706061 00          BCD 1NARY /
03174 +303144212731 00          BCD 1HIMAGI
03175 -200101677311 00          BCD 1 11X,9
03176 +043051252143 00          BCD 14HREAL
03177 -306001006773 00          BCD 1Y 10X,
03200 +212731452151 00          BCD 1AGINAR
03201 -206011303144 00          BCD 1  9HIM
03202 -206060606060 00          BCD 1
03203 -206060606060 00          BCD 1
03204 +010067736060 00          BCD 110X,
03205 +305125214360 00          BCD 1HREAL
03206 -200101677304 00          BCD 1 11X,4
03207 +273145215170 00          BCD 1GINARY
03210 -331130314421 00          BCD 1,9HIMA
03211 +214360010167 00          BCD 1AL 11X
03212 -277304305125 00          BCD 1X,4HRE
03213 -340130600102 00  8)SN     BCD 1(1H 12
03214 +216225616134 00          BCD 1ASE//)
03215 -206005306023 00          BCD 1  5H C
03216 -206060606060 00          BCD 1
03217 -206060606060 00          BCD 1
03220 -306060606060 00          BCD 1Y
03221 -034321634651 00          BCD 1LLATOR
03222 +256046622331 00          BCD 1E OSCI
03223 +010630606330 00          BCD 116H TH
03224 -216104106773 00          BCD 1//48X,
03225 -236213013103 00          BCD 1TS=1I3
03226 -036047463145 00          BCD 1L POIN
03227 +234645635146 00          BCD 1CONTRO
03230 -206001063060 00          BCD 1  16H
03231 -206060606060 00          BCD 1
03232 -206060606060 00          BCD 1
03233 -206060606060 00          BCD 1
03234 +222551604626 00          BCD 1BER OF
03235 +003060456444 00          BCD 10H NUM
03236 -210406677301 00          BCD 1/46X,1
03237 +250105331061 00          BCD 1E15.8/
03240 +336142511301 00          BCD 1./KR=1
03241 -277307306001 00          BCD 1X,7H 1
03242 -340130600411 00  8)2L     BCD 1(1H 49
03243 +010501310334 00          BCD 1151I3)
03244 +305164603044 00          BCD 1HRU HM
03245 -200100306063 00          BCD 1 10H T
03246 -206060606060 00          BCD 1
03247 -206060606060 00          BCD 1
03250 -206060606060 00          BCD 1
03251 -336060606060 00          BCD 1,
03252 -040105013103 00          BCD 1M151I3
03253 -054662336030 00          BCD 1NOS. H
03254 +232151246260 00          BCD 1CARDS
03255 -052330252460 00          BCD 1NCHED
03256 +020430604764 00          BCD 124H PU
03257 -346103106773 00  8)75     BCD 1(/38X,
03260 -222561613460 00          BCD 1SE//)
03261 +212470602321 00          BCD 1ADY CA
03262 +302560626325 00          BCD 1HE STE
03263 -330106306063 00          BCD 1,16H T
03264 +036161041167 00          BCD 13//49X
03265 -236260130131 00          BCD 1TS =1I
03266 -036047463145 00          BCD 1L POIN
03267 +234645635146 00          BCD 1CONTRO
03270 -206001073060 00          BCD 1  17H
03271 -206060606060 00          BCD 1
03272 -206060606060 00          BCD 1
03273 -206060606060 00          BCD 1
03274 +222551604626 00          BCD 1BER OF
03275 +003060456444 00          BCD 10H NUM
```

```
03276 -210406677301 00          BCD 1/46X,1
03277 +250105331061 00          BCD 1E15.8/
03300 +336142511301 00          BCD 1./KR=1
03301 -277307306001 00          BCD 1X,7H 1
03302 -340130600411 00  8)28    BCD 1(1H 49
03303 +316760616134 00          BCD 1IX //)
03304 +316044216351 00          BCD 1I MATR
03305 -233025602330 00          BCD 1THE CH
03306 -277301053060 00          BCD 1X,15H
03307 -346161600411 00  8)23    BCD 1(// 49
03310 +346060606060 00          BCD 1)
03311 -113167606160 00          BCD 1RIX /
03312 +302460442163 00          BCD 1HD MAT
03313 -206330256023 00          BCD 1 THE C
03314 +116773010530 00          BCD 19X,15H
03315 -346061616004 00  8)22    BCD 1( // 4
03316 +316760616034 00          BCD 1IX / )
03317 -226044216351 00          BCD 1S MATR
03320 -233025602330 00          BCD 1THE CH
03321 -277301053060 00          BCD 1X,15H
03322 -340130600411 00  8)PK    BCD 1(1H 49
03323 +216225616134 00          BCD 1ASE//)
03324 -206005306023 00          BCD 1  5H C
03325 -206060606060 00          BCD 1
03326 -206060606060 00          BCD 1
03327 -206060606060 00          BCD 1
03330 -056231254563 00          BCD 1NSIENT
03331 +302560635121 00          BCD 1HE TRA
03332 -330104306063 00          BCD 1,14H T
03333 +036161041167 00          BCD 13//49X
03334 -236260130131 00          BCD 1TS =1I
03335 -036047463145 00          BCD 1L POIN
03336 +234645635146 00          BCD 1CONTRO
03337 -206001073060 00          BCD 1  17H
03340 -206060606060 00          BCD 1
03341 -206060606060 00          BCD 1
03342 -206060606060 00          BCD 1
03343 +222551604626 00          BCD 1BER OF
03344 +003060456444 00          BCD 10H NUM
03345 -210406677301 00          BCD 1/46X,1
03346 +250105331061 00          BCD 1E15.8/
03347 +336142511301 00          BCD 1./KR=1
03350 -277307306001 00          BCD 1X,7H 1
03351 -340130600411 00  8)2E    BCD 1(1H 49
03352 +346060606060 00          BCD 1)
03353 +036773013103 00          BCD 13X,1I3
03354 -340131047307 00  8)12    BCD 1(1I4,7
03355 +013103346060 00          BCD 1I3)
03356 +107306056773 00          BCD 18,65X,
03357 -340125010233 00  8)2M    BCD 1(1E12.
03360 +103434606060 00          BCD 18))
03361 -330125010533 00          BCD 1,1E15.
03362 +331073010367 00          BCD 1.8,13X
03363 -206001250105 00          BCD 1  1E15
03364 -206060606060 00          BCD 1
03365 -206060606060 00          BCD 1
03366 -206060606060 00          BCD 1
03367 +026773606060 00          BCD 12X,
03370 -330131047302 00          BCD 1,1I4,2
03371 -216174020367 00          BCD 1///(23X
03372 -274574313473 00          BCD 1XN(I),
03373 -074631456360 00          BCD 1POINT
03374 -056351464360 00          BCD 1NTROL
03375 +020030602346 00          BCD 120H CO
03376 -206001046773 00          BCD 1  14X,
03377 -206060606060 00          BCD 1
03400 -206060606060 00          BCD 1
03401 -277431346060 00          BCD 1X(I)
03402 -202425436321 00          BCD 1 DELTA
03403 +076773010030 00          BCD 17X,10H
03404 -204546336001 00          BCD 1 NO. 1
03405 -064360476333 00          BCD 10L PT.
03406 -202346456351 00          BCD 1 CONTR
03407 -277360010630 00          BCD 1X, 16H
03410 -340130600107 00  8)1D    BCD 1(1H 17
03411 -206161346060 00          BCD 1 //)
```

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03412 -236024216321 00        BCD 1T DATA
03413 -204664634764 00        BCD 1 OUTPU
03414 +026773010230 00        BCD 12X,12H
03415 -346061616005 00 8)4C   BCD 1( // 5
03416 +331034346060 00        BCD 1.8))
03417 -277301250105 00        BCD 1X,1E15
03420 +053310730110 00        BCD 15.8,18
03421 +056773012501 00        BCD 15X,1E1
03422 -206060607403 00        BCD 1    (3
03423 -206060606060 00        BCD 1
03424 -206060606060 00        BCD 1
03425 -206060606060 00        BCD 1
03426 -216060606060 00        BCD 1/
03427 -202151252161 00        BCD 1 AREA/
03430 -204346232143 00        BCD 1 LOCAL
03431 -277301023060 00        BCD 1X,12H
03432 -343134730204 00        BCD 1(I),24
03433 -277305306067 00        BCD 1X,5H X
03434 -340130600311 00 8)3J   BCD 1(1H 39
03435 -216134606060 00        BCD 1//)
03436 +012501053310 00        BCD 11E15.8
03437 -206251252613 00        BCD 1 SREF=
03440 +041167730630 00        BCD 149X,6H
03441 +250105331061 00        BCD 1E15.8/
03442 +033060621301 00        BCD 13H S=1
03443 +106105026773 00        BCD 18/52X,
03444 +130125010533 00        BCD 1=1E15.
03445 -330430602251 00        BCD 1,4H BR
03446 -206061050167 00        BCD 1  /51X
03447 -206060606060 00        BCD 1
03450 -206060606060 00        BCD 1
03451 +010533106060 00        BCD 115.8
03452 +222151130125 00        BCD 1BAR=1E
03453 -277306306023 00        BCD 1X,6H C
03454 +256261610411 00        BCD 1ES//49
03455 -034623316331 00        BCD 1LOCITI
03456 +232524606525 00        BCD 1CED VE
03457 +306051252464 00        BCD 1H REDU
03460 +013104730111 00        BCD 11I4,19
03461 -206004076773 00        BCD 1  47X,
03462 -206060606060 00        BCD 1
03463 -206060606060 00        BCD 1
03464 -226160606060 00        BCD 1S/
03465 +252363314645 00        BCD 1ECTION
03466 +047311306062 00        BCD 14,9H S
03467 +040767730131 00        BCD 147X,1I
03470 +242163216161 00        BCD 1DATA//
03471 +314547646360 00        BCD 1INPUT
03472 -277301013060 00        BCD 1X,11H
03473 -340130600411 00 8)4    BCD 1(1H 49
03474 -216134606060 00        BCD 1//)
03475 -233025465170 00        BCD 1THEORY
03476 -002246247060 00        BCD 1-BODY
03477 -032545242551 00        BCD 1LENDER
03500 +265146446062 00        BCD 1FROM S
03501 -206002053060 00        BCD 1  25H
03502 -206060606060 00        BCD 1
03503 -206060606060 00        BCD 1
03504 +312545636260 00        BCD 1IENTS
03505 -062526263123 00        BCD 1OEFFIC
03506 +254523256023 00        BCD 1ENCE C
03507 -203145264364 00        BCD 1 INFLU
03510 -304521443123 00        BCD 1YNAMIC
03511 -202125514624 00        BCD 1 AEROD
03512 +116773030530 00        BCD 19X,35H
03513 -340130016002 00 8)PE   BCD 1(1H1 2
03514 -216134606060 00        BCD 1//)
03515 -233025465170 00        BCD 1THEORY
03516 -002246247060 00        BCD 1-BODY
03517 -032545242551 00        BCD 1LENDER
03520 +265146446062 00        BCD 1FROM S
03521 -206002053060 00        BCD 1  25H
03522 -206060606060 00        BCD 1
03523 -206060606060 00        BCD 1
03524 +254563626060 00        BCD 1ENTS
03525 +252626312331 00        BCD 1EFFICI
```

```
03526 -052325602346 00          BCD 1NCE CO
03527 +314526436425 00          BCD 1INFLUE
03530 -052144312360 00          BCD 1NAMIC
03531 +212551462470 00          BCD 1AERODY
03532 -277303053060 00          BCD 1X,35H
03533 -340130600211 00  8)PD     BCD 1(1H 29
03534 +066061613460 00          BCD 16 //)
03535 +016773010221 00          BCD 11X,12A
03536 -340130016003 00  8)FL     BCD 1(1H1 3
03537 +103460606060 00          BCD 18)
03540 -340625010233 00  8)43    BCD 1(6E12.
03541 +103460606060 00          BCD 18)
03542 -340625010233 00  8)19    BCD 1(6E12.
03543 +023310343460 00          BCD 12.8))
03544 +106174062501 00          BCD 18/(6E1
03545 -340425010233 00  8)18    BCD 1(4E12.
03546 -340110310434 00  8)3     BCD 1(18I4)
03547 -340102210634 00  8)1     BCD 1(12A6)
```

```
BEGIN COMPILATION 14.507
```

```
C       SUBROUTINE MPRINT  (A,M,N,MA,NTAPE )                                  MPRINT01
C                                                                             MPRINT02
C            A = MATRIX TO BE PRINTED                                         MPRINT03
C            M = NUMBER OF ROWS          MA = DIMENSIONED NUMBER OF ROWS      MPRINT04
C            N = NUMBER OF COLUMNS       NTAPE = TAPE NUMBER FOR PRINTING     MPRINT05
C                                                                             MPRINT06
      SUBROUTINE MPRINT  (A,M,N,MD,NTAPE )                                    MPRINT07
*     LIST8                                                                   MPRINT08
      DIMENSION   A(1), IT(6), C(6)                                           MPRINT09
      EQUIVALENCE  (IT,C)                                                     MPRINT10
                                                                              MPRINT11
    2 FORMAT   (1H , 4X, 6( 6X, 7HCOLUMN   1I4  )   ///    )                  MPRINT12
    3 FORMAT   (1H  1I4, X,   (6E 17.8)  )                                    MPRINT13
                                                                              MPRINT14
      N1=N                                                                    MPRINT15
      N2=6                                                                    MPRINT16
      N3=6                                                                    MPRINT17
      N4=1                                                                    MPRINT18
    4 IF (N3-N1)  6,6,5                                                       MPRINT19
    5 N2=N1-N3+6                                                              MPRINT20
      N3=N1                                                                   MPRINT21
    6 K=0                                                                     MPRINT22
      DO  7  I= N4,N3                                                         MPRINT23
        K=K+1                                                                 MPRINT24
    7   IT(K)=I                                                               MPRINT25
      WRITEOUTPUTTAPE NTAPE, 2,  (IT(I),I=1,N2)                               MPRINT27
      DO  9  I=1,M                                                            MPRINT28
        K=0                                                                   MPRINT29
        L=MD*(N4-1)+I                                                         MPRINT30
        DO  8  J=N4,N3                                                        MPRINT31
          K=K+1                                                               MPRINT32
          C(K)=A(L)                                                           MPRINT33
    8     L=L+MD                                                            MPRINT34
    9   WRITEOUTPUTTAPE NTAPE, 3, I,  (C(K),K=1,N2)                           MPRINT35
      IF (N3-N1) 10,11,11                                                     MPRINT36
   10 N3=N3+6                                                                 MPRINT37
      N4=N4+6                                                                 MPRINT38
      GOTO  4                                                                 MPRINT39
```

```
   11 RETURN
      END(1,1,0,0,0,0,0,1,0,1,0,0,0,0,0)
```

STORAGE NOT USED BY PROGRAM

DEC	OCT	DEC	OCT
192	00300	32561	77461

STORAGE LOCATIONS FOR VARIABLES APPEARING IN DIMENSION AND EQUIVALENCE STATEMENTS

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
C	191	00277	IT	191	00277						

STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN COMMON, DIMENSION, OR EQUIVALENCE STATEMENTS

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
I	185	00271	K	184	00270	L	183	00267	N1	182	00266
N2	181	00265	N3	180	00264	N4	179	00263			

SYMBOLS AND LOCATIONS FOR SOURCE PROGRAM FORMAT STATEMENTS

	EFN	LOC		EFN	LOC		EFN	LOC		EFN	LOC
8)2	2	00254	8)3	3	00244						

LOCATIONS FOR OTHER SYMBOLS NOT APPEARING IN SOURCE PROGRAM

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
1)	174	00256	2)	151	00227	6)	154	00232	9)	173	00255
C)G0	176	00260	C)G2	177	00261	C)202	178	00262	E)E	139	00213

LOCATIONS OF NAMES IN TRANSFER VECTOR

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
(FIL)	1	00001	(STH)	0	00000						

ENTRY POINTS TO SUBROUTINES NOT OUTPUT FROM LIBRARY

(FIL) (STH)

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EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC
4	11	00040	5	12	00045	6	14	00053	7	17	00071
8	29	00153	9	30	00161	10	37	00214	11	40	00223

```
00000 -346263303460 00   (STH)   BCD 1(STH)
00001 -342631433460 00   (FIL)   BCD 1(FIL)
00002 +000000000000 00   $       PZE
00003 +000000000000 00           PZE
00004 +000000000000 00           PZE
00005 -044751314563 00           BCD 1MPRINT
00006 -063400100002 010          SXD $,1
00007 -063400200003 010          SXD $+1,2
00010 -063400400004 010          SXD $+2,4
00011 +050000400001 00           CLA 1,4
00012 +040000000255 010          ADD 9)
00013 +062100000151 010          STA 1A+83
00014 +050000400002 00           CLA 2,4
00015 +062100000117 010          STA 1A+57
00016 +050000400003 00           CLA 3,4
00017 +062100000030 010          STA 1A+2
00020 +050000400004 00           CLA 4,4
00021 +062100000154 010          STA 1A+86
00022 +062100000132 010          STA 1A+68
00023 +050000400005 00           CLA 5,4
00024 +062100000161 010          STA 1A+91
00025 +062100000076 010          STA 1A+40
00026 +050000000002 00   1A      CLA 2
00027 +060100000237 010          STO 6)+5
00030 +050000000000 00   7A      CLA N
00031 +060100000266 010          STO N1
00032 +050000000227 010  8A      CLA 2)
00033 +060100000265 010          STO N2
00034 +050000000227 010  9A      CLA 2)
00035 +060100000264 010          STO N3
00036 +050000000230 010  10A     CLA 2)+1
00037 +060100000263 010          STO N4
00040 +050000000264 010  11A     CLA N3
00041 +040200000266 010          SUB N1
00042 +010000000053 010  11A1    TZE 14A
00043 +012000000045 010          TPL 12A
00044 +002000000053 010          TRA 14A
00045 +050000000266 010  12A     CLA N1
00046 +040200000264 010          SUB N3
00047 +040000000227 010          ADD 2)
00050 +060100000265 010          STO N2
00051 +050000000266 010  13A     CLA N1
00052 +060100000264 010          STO N3
00053 +050000000231 010  14A     CLA 2)+2
00054 +060100000270 010          STO K
00055 -053400100270 010          LXD K,1
00056 -063400100260 010          SXD C)GO,1
00057 -053400200263 010  15A     LXD N4,2
00060 +050000000264 010          CLA N3
00061 +062200000075 010          STD 17A2
00062 -075400200000 00           PXD 0,2
00063 +060100000271 010          STO I
00064 +050000000270 010  16A     CLA K
00065 +040000000230 010          ADD 2)+1
00066 +060100000270 010          STO K
00067 -053400400270 010          LXD K,4
00070 -063400400260 010          SXD C)GO,4
00071 +050000000271 010  17A     CLA I
00072 +060100400300 011          STO IT+1,4
00073 +100001200074 010  17A1    TXI *+1,2,1
00074 -063400200271 010          SXD I,2
00075 -300000200064 010  17A2    TXL 16A,2
00076 -050000000000 00   18A     CAL NTAPE
00077 -063400400236 010          SXD 6)+4,4
00100 +007400400000 010          TSX (STH),4
00101 +000000000254 010          PZE 8)2
00102 -053400400236 010          LXD 6)+4,4
00103 -053400100230 010  19A     LXD 2)+1,1
00104 +050000000265 010          CLA N2
00105 +062200000111 010          STD 20A2
00106 +056000100300 011  20A     LDQ IT+1,1
00107 -100000000000 00           STR
00110 +100001100111 010  20A1    TXI *+1,1,1
00111 -300000100106 010  20A2    TXL 20A,1
00112 -063400400236 010  22A     SXD 6)+4,4
00113 +007400400001 010          TSX (FIL),4
```

```
00114 -053400400236 010       LXD 6)+4,4
00115 -053400100230 010 23A   LXD 2)+1,1
00116 -063400100262 010       SXD C)202,1
00117 +050000000000 00        CLA M
00120 +062200000206 010       STD 35A2
00121 -075400100000 00        PXD 0,1
00122 +060100000271 010       STO I
00123 +050000000231 010 24A   CLA 2)+2
00124 +060100000270 010       STO K
00125 -053400200270 010       LXD K,2
00126 -063400200260 010       SXD C)G0,2
00127 +050000000263 010 25A   CLA N4
00130 +040200000230 010       SUB 2)+1
00131 +060100000257 010       STO 1)+1
00132 +056000000000 00        LDQ MD
00133 +020000000257 010       MPY 1)+1
00134 +076700000021 00        ALS 17
00135 +040000000271 010       ADD I
00136 +060100000267 010       STO L
00137 -053400400267 010       LXD L,4
00140 -063400400261 010       SXD C)G2,4
00141 -053400200263 010 26A   LXD N4,2
00142 +050000000264 010       CLA N3
00143 +062200000160 010       STD 29A2
00144 +050000000270 010 27A   CLA K
00145 +040000000230 010       ADD 2)+1
00146 +060100000270 010       STO K
00147 -053400100270 010       LXD K,1
00150 -063400100260 010       SXD C)G0,1
00151 +050000400000 00  28A   CLA A+1,4
00152 +060100100300 011       STO C+1,1
00153 +050000000267 010 29A   CLA L
00154 +040000000000 00        ADD MD
00155 +060100000267 010       STO L
00156 -053400400267 010       LXD L,4
00157 +100001200160 010 29A1  TXI *+1,2,1
00160 -300000200144 010 29A2  TXL 27A,2
00161 -050000000000 00  30A   CAL NTAPE
00162 -063400400236 010       SXD 6)+4,4
00163 +007400400000 010       TSX (STH),4
00164 +000000000244 010       PZE 8)3
00165 -053400400236 010       LXD 6)+4,4
00166 +056000000271 010 31A   LDQ I
00167 -100000000000 00        STR
00170 -053400100230 010 32A   LXD 2)+1,1
00171 +050000000265 010       CLA N2
00172 +062200000176 010       STD 33A2
00173 +056000100300 011 33A   LDQ C+1,1
00174 -100000000000 00        STR
00175 +100001100176 010 33A1  TXI *+1,1,1
00176 -300000100173 010 33A2  TXL 33A,1
00177 -063400400236 010 35A   SXD 6)+4,4
00200 +007400400001 010       TSX (FIL),4
00201 -053400400236 010       LXD 6)+4,4
00202 -053400100262 010       LXD C)202,1
00203 +100001100204 010 35A1  TXI *+1,1,1
00204 -063400100262 010       SXD C)202,1
00205 -063400100271 010       SXD I,1
00206 -300000100123 010 35A2  TXL 24A,1
00207 +050000000264 010 36A   CLA N3
00210 +040200000266 010       SUB N1
00211 +010000000223 010 36A1  TZE 40A
00212 +012000000223 010       TPL 40A
00213 -063400400261 010 E)E   SXD C)G2,4
00214 +050000000264 010 37A   CLA N3
00215 +040000000227 010       ADD 2)
00216 +060100000264 010       STO N3
00217 +050000000263 010 38A   CLA N4
00220 +040000000227 010       ADD 2)
00221 +060100000263 010       STO N4
00222 +002000000040 010 39A   TRA 11A
00223 -053400100002 010 40A   LXD $,1
00224 -053400200003 010       LXD $+1,2
00225 -053400400004 010       LXD $+2,4
00226 +002000400006 00        TRA 6,4
00227 +000006000000 00  2)    OCT +000006000000
```

```
00230 +000001000000 00          OCT +000001000000
00231 +000000000000 00          OCT +000000000000
00232 +233000000000 00  6)      OCT +233000000000
00233 +000000377777 00          OCT +000000377777
00234 +000000000000 00          OCT +000000000000
00235 +000001000000 00          OCT +000001000000
00236 +000000000000 00          OCT +000000000000
00237 +000000000000 00          OCT +000000000000
00240 +331034606034 00          BCD 1.8)  )
00241 -340625600107 00          BCD 1(6E 17
00242 -206773606060 00          BCD 1 X,
00243 -206001310473 00          BCD 1  1I4,
00244 -206060740130 00  8)3     BCD 1   (1H
00245 -216060606034 00          BCD 1/    )
00246 +346060606161 00          BCD 1)   //
00247 -200131046060 00          BCD 1 1I4
00250 -036444456060 00          BCD 1LUMN
00251 -336007302346 00          BCD 1, 7HCO
00252 -200674600667 00          BCD 1 6( 6X
00253 -207360046773 00          BCD 1 , 4X,
00254 -206060740130 00  8)2     BCD 1   (1H
00255 +000000000001 00  9)      OCT +000000000001
```

```
*       FAP                                                    BINPU002

    BEGIN ASSEMBLY     14.514
CARD-COUNT ESTIMATE MISSING.
```

```
                        ********************************************************************************BINPU005
                        *                                                                              BINPU006
                        * CALLING SEQUENCE                                                             BINPU007
                        *       TSX     BINPU,4                                                        BINPU008
                        *       TSX     LOC (ARRAY TO BE PUNCHED)                                      BINPU009
                        *       TSX     LOC (NO. WORDS TO PUNCH)                                       BINPU010
                        *       TSX     LOC (CARD ORIGIN FOR 1ST CARD)                                 BINPU011
                        *      *TSX     LOC (SEQ NO. OF 1ST CARD)                                      BINPU012
                        *      *TSX     LOC (BCD ID FOR THIS DECK, 1ST AND 2ND CHARACTER BLANKS)       BINPU013
                        *       TSX     LOC (OUTPUT TAPE NUMBER)                                       BINPU013
                        *****CONTRARY TO BELOW, NO ITEMS MAY BE OMITTED IN THIS MODIFICATION.          BINPU013
                        *                                                                              BINPU014
                        * ITEMS MARKED (*) MAY BE DELETED. BCD ID WILL BE                              BINPU015
                        *       UNCHANGED AND SEQ. NOS. WILL BE CONTINUOUS STARTING                    BINPU016
                        *       FROM  000. ALSO ORDER MAY BE SWITCHED.                                 BINPU017
                        *                                                                              BINPU018
                        * THIS VERSION PUNCHES OFF-LINE ONLY.                                          BINPU019
                        *                                                                              BINPU020
                        ********************************************************************************BINPU021
                  00006         ENTRY   BINPU                                                          BINPU022
                        *                                                                              BINPU023

  TRANSFER VECTOR
00000   743146623460    (IOS)
00001   746651623460    (WRS)
00002   745123303460    (RCH)
00003   746663233460    (WTC)
00004   746625513460    (WER)
00005   746325623460    (TES)

00006   0634 00 1 00142  BINPU SXA      X1,1                                                          BINPU024
00007   0634 00 2 00143         SXA     X2,2                                                          BINPU025
00010  -0500 60 4 00006         CAL*    6,4                                                           BINPU025
00011   0622 00 0 00331         STD     14D                                                           BINPU025
00012   0500 00 4 00001         CLA     1,4             LOC OF ARRAY                                  BINPU026
00013   0621 00 0 00062         STA     ARRAY                                                         BINPU027
00014  -0500 60 4 00002         CAL*    2,4             WORD COUNT                                    BINPU028
00015   0602 00 0 77776         SLW     END             END=0 IF TRANSFER CARD                        BINPU029
```

```
00016  0402 00 0 00325          SUB     D1                                      BINPU030
00017  0622 00 0 00066          STD     LOCN                                    BINPU031
00020  0634 00 0 00061          SXA     COUNT,0                                 BINPU032
00021  0500 60 4 00003          CLA*    3,4             SET UP CONTROL WORD     BINPU033
00022  0771 00 0 00022          ARS     18                                      BINPU034
00023 -0120 00 0 00025          TMI     *+2                                     BINPU035
00024 -0501 00 0 00266          ORA     REL             ADD RELATIVE BIT        BINPU036
00025 -0501 00 0 00334          ORA     IMAGE           7-9, WORD COUNT=22      BINPU037
00026  0602 00 0 77740          SLW     CIMAGE          CONTROL WORD ESTABLISHED.BINPU038
                        ********************************************************BINPU039
                        *       TEST FOR FOURTH AND-OR FIFTH ARGUMENTS.         BINPU040
                        *       DETERMINE WHETHER ARGUMENT REFERS TO ID OR SEQ NUMBER BINPU041
                        *       AND SET CELLS FROM CALLING SEQUENCE.            BINPU042
                        ********************************************************BINPU043
00027  0774 00 2 00002          AXT     2,2                                     BINPU044
00030 -0625 00 0 00302          STL     BLSEQ           SET BLSEQ TO ITS NORMAL STATE BINPU045
00031 -0500 00 4 00004  G4      CAL     4,4             TEST FOR 4TH, 5TH ARGS  BINPU046
00032 -0320 00 0 00265          ANA     MSKPDT                                  BINPU047
00033  0322 00 0 00307          ERA     MSKTSX                                  BINPU048
00034 -0100 00 0 00054          TNZ     G2              NO MORE TSXES           BINPU049
00035  0500 60 4 00004          CLA*    4,4                                     BINPU050
00036 -0340 00 0 00262          LAS     BCI8                                    BINPU051
00037  0020 00 0 00051          TRA     G3              BIG, THIS IS ID         BINPU052
00040  0600 00 0 00302          STZ     BLSEQ           EQUAL, FLAG BLANK SEQ. NO. BINPU053
00041 -0100 00 0 00043          TNZ     *+2             IS SEQ NO NON-ZERO.     BINPU054
T 00042 -0754 00 0 00000        PXD                     NO                      BINPU055
00043 -0130 00 0 00000          XCL                     SMALL, THIS IS SEQ NO.  BINPU056
00044  0634 00 4 00046          SXA     *+2,4                                   BINPU057
00045  0074 00 4 00172          TSX     COSEQ,4         CONVERT SEQ NO TO BCD   BINPU058
00046  0774 00 4 00000          AXT     **,4                                    BINPU059
00047  0602 00 0 00267          SLW     SEQNO           SAVE                    BINPU060
00050  1 77777 4 00053          TXI     G5,4,-1                                 BINPU061
00051  0601 00 0 00305  G3      STO     BCDID                                   BINPU062
00052  1 77777 4 00053          TXI     G5,4,-1         MOVE TO NEXT ARGUMENT   BINPU063
00053  2 00001 2 00031  G5      TIX     G4,2,1          AT MOST 2 EXTRA ARGS.   BINPU064
00054  0634 00 4 00144  G2      SXA     X4,4                                    BINPU065
00055 -0520 00 0 77776          NZT     END             IS WORD COUNT ZERO      BINPU066
00056  0020 00 0 00152          TRA     TRCD            MUST BE A TRANSFER CARD BINPU067
```

```
                                *                                                                    BINPU068
                                ************************************************************************BINPU069
                                *       BUILD THE CARD IMAGE.                                        BINPU070
                                ************************************************************************BINPU071
                                *                                                                    BINPU072
     00057  0774 00 2 00026  NEXT   AXT     22,2                                                    BINPU073
T    00060 -0754 00 0 00000         PXD                          CLEAR AC FOR CHECKSUM.             BINPU074
     00061  0774 00 4 00000  COUNT  AXT     **,4                                                    BINPU075
     00062  0560 00 4 00000  ARRAY  LDQ     **,4                 MOVE ARRAY INTO CORE.              BINPU076
     00063 -0600 00 2 77770         STQ     CIMAGE+24,2                                             BINPU077
     00064  0361 00 2 77770         ACL     CIMAGE+24,2          ACCUMULATE CHECKSUM FOR BODY.      BINPU078
     00065  1 00001 4 00066         TXI     *+1,4,1                                                 BINPU079
     00066  3 00000 4 00160  LOCN   TXH     OUT,4,**             FINISH WHEN SPECIFIED              BINPU080
     00067  2 00001 2 00062         TIX     ARRAY,2,1            BY NO. WORDS DESIRED.(2,4)         BINPU081
     00070  0634 00 4 00061  IN     SXA     COUNT,4              SET COUNT FOR NEXT LOOP.           BINPU082
     00071  0361 00 0 77740         ACL     CIMAGE               ADD IN CONTROL WORD.               BINPU083
     00072  0602 00 0 77741         SLW     CIMAGE+1             PUT CHECKSUM IN IMAGE.             BINPU084
                                *                                                                    BINPU085
                                ************************************************************************BINPU086
                                *       EDIT THE IDENTIFICATION FIELD.                               BINPU087
                                ************************************************************************BINPU088
                                *                                                                    BINPU089
     00073 -0500 00 0 00267  EDIT   CAL     SEQNO                                                   BINPU090
     00074  0560 00 0 00327         LDQ     L(1)                                                    BINPU091
     00075 -0765 00 0 00022         LGR     18                                                      BINPU092
     00076 -0500 00 0 00305         CAL     BCDID                                                   BINPU093
     00077 -0763 00 0 00006         LGL     6                                                       BINPU094
     00100 -0600 00 0 00326         STQ     IDLCD                SAVE FOR FINISHING.                BINPU095
     00101 -0130 00 0 00000         XCL                                                             BINPU096
     00102  0634 00 1 00120         SXA     SV1,1                                                   BINPU097
     00103  0774 00 2 00004         AXT     4,2                                                     BINPU098
     00104  0774 00 4 00002         AXT     2,4                                                     BINPU099
     00105  0774 00 1 00003  ABC    AXT     3,1                                                     BINPU100
T    00106 -0754 00 0 00000         PXD                                                             BINPU101
     00107 -0114 01 0 00230         CAQ     TAB,,1                                                  BINPU102
     00110 -2 00001 1 00113         TNX     *+3,1,1                                                 BINPU103
     00111  0767 00 0 00014         ALS     12                                                      BINPU104
     00112  0020 00 0 00107         TRA     *-3                                                     BINPU105
```

```
00113  0602 00 2 77734          SLW     LAST+4,2          COL BIN AT LAST TO LAST+3          BINPU106
00114  1 77777 2 00115          TXI     *+1,2,-1                                             BINPU107
00115  2 00001 4 00105          TIX     ABC,4,1                                              BINPU108
00116  0560 00 0 00326          LDQ     IDLCD             FINISH W/SAVED C(MQ).              BINPU109
00117  3 00000 2 00104          TXH     ABC-1,2,0                                            BINPU110
00120  0774 00 1 00000  SV1     AXT     **,1                                                 BINPU111
                        *                                                                    BINPU112
                        ********************************************************************BINPU113
                        *       THE ENTIRE CARD IMAGE IS BUILT, WITH THE BODY                BINPU114
                        *       AT CIMAGE THRU CIMAGE+23, AND ID AT LAST THRU LAST+3.        BINPU115
                        *       NOW  ***** WRITE THE CARD ON TAPE. ********                  BINPU116
                        ********************************************************************BINPU117
00121  0761 00 0 00000  WRITE   NOP                                                         BINPU118
00122 -0500 00 0 00331  WRITE1  CAL     14D                                                  BINPU119
00123  0074 00 4 00000          CALL    (IOS)             ESTABLISH I/O FOR TAPE 14.         BINPU120
00124  0522 60 0 00001          XEC*    $(WRS)                                               BINPU121
00125 -0774 00 4 00213          AXC     PUNCMD,4                                             BINPU122
00126  0522 60 0 00002          XEC*    $(RCH)                                               BINPU123
00127  0754 00 4 00000          PXA     0,4               SET (WER) FOR RETRY.               BINPU124
00130  0621 60 0 00003          STA*    $(WTC)                                               BINPU125
00131  0074 00 4 00004  BPTES   TSX     $(WER),4                                             BINPU126
00132 -0500 00 0 00267          CAL     SEQNO                                                BINPU127
00133  0400 00 0 00327          ADD     L(1)              INCREMENT CARD COUNT.              BINPU128
00134  0114 06 0 00215          CVR     TB1,,6                                               BINPU129
00135  0602 00 0 00267          SLW     SEQNO                                                BINPU130
00136  0520 00 0 77776          ZET     END               TEST IF LAST CARD.                 BINPU131
00137  0020 00 0 00146          TRA     SWTCH                 NOT THE LAST CARD....          BINPU132
00140 -0500 00 0 00131          CAL     BPTES                                                BINPU133
00141  0602 60 0 00005          SLW*    $(TES)                                               BINPU134
00142  0774 00 1 00000  X1      AXT     **,1                  ALL DONE. EXIT                 BINPU135
00143  0774 00 2 00000  X2      AXT     **,2                                                 BINPU136
00144  0774 00 4 00000  X4      AXT     **,4                                                 BINPU137
00145  0020 00 4 00005          TRA     5,4                                                  BINPU138
                        *                                                                    BINPU139
                        ********************************************************************BINPU140
00146 -0500 00 0 77740  SWTCH   CAL     CIMAGE              UPDATE THE CARD ORIGIN.        BINPU141
00147  0361 00 0 00333          ACL     A22                                                  BINPU142
00150  0602 00 0 77740          SLW     CIMAGE                                               BINPU143
```

```
00151  0020 00 0 00057          TRA     NEXT                                                    BINPU144
                        ********************************************************************BINPU145
                        *                                                                       BINPU146
00152  0774 00 2 00027   TRCD   AXT     23,2                CLEAR REST OF                      BINPU147
00153  0600 00 2 77770          STZ     CIMAGE+24,2         CARD IMAGE.                        BINPU148
00154  2 00001 2 00153          TIX     *-1,2,1                                                BINPU149
00155  0500 00 0 00322          CLA     ZWC                 STORE ZERO WORD COUNT              BINPU150
00156  0622 00 0 77740          STD     CIMAGE                                                 BINPU151
00157  0020 00 0 00073          TRA     EDIT                                                   BINPU152
                        *                                                                       BINPU153
                        ********************************************************************BINPU154
                        *                                                                       BINPU155
00160  0600 00 0 77776   OUT    STZ     END                 WORD COUNT EXHAUSTED               BINPU156
00161 -2 00001 2 00070          TNX     IN,2,1              RETURN IF CARD IS FULL             BINPU157
00162  0602 00 0 77777          SLW     COMMON              SAVE CHECKSUM.                     BINPU158
00163 -0754 00 2 00000          PXD     0,2                 CORRECT WORD COUNT                 BINPU159
00164  0402 00 0 77740          SUB     CIMAGE                                                 BINPU160
00165  0622 00 0 77740          STD     CIMAGE                                                 BINPU161
00166 -0500 00 0 77777          CAL     COMMON              RETURN CHECKSUM.                   BINPU162
00167 -3 00000 2 00070          TXL     IN,2,0                                                 BINPU163
00170  0600 00 2 77770          STZ     CIMAGE+24,2         CLEAR REST OF CARD.                BINPU164
00171  1 77777 2 00167          TXI     *-2,2,-1                                               BINPU165
                        *                                                                       BINPU166
                        ********************************************************************BINPU167
                        * THIS ROUTINE CONVERTS A BINARY INTEGER TO BCD. (4 DIGITS DECR-MQ)     BINPU168
                        ********************************************************************BINPU169
                        *                                                                       BINPU170
T    00172 -0754 00 0 00000  COSEQ  PXD                                                        BINPU171
     00173 -0520 00 0 00302          NZT     BLSEQ           TEST IF BLANKS DESIRED.            BINPU172
     00174  0020 00 0 00211          TRA     COSEQX                                             BINPU173
     00175  0765 00 0 00022          LRS     18              RIGHT ADJUST BIN INTEGER           BINPU174
     00176  0221 00 0 00332          DVP     TEN                                                BINPU175
     00177  0601 00 0 77777          STO     COMMON                                             BINPU176
T    00200 -0754 00 0 00000          PXD                                                        BINPU177
     00201  0221 00 0 00332          DVP     TEN                                                BINPU178
     00202  0767 00 0 00006          ALS     6                                                  BINPU179
     00203 -0602 00 0 77777          ORS     COMMON                                             BINPU180
T    00204 -0754 00 0 00000          PXD                                                        BINPU181
```

```
00205  0221 00 0 00332          DVP     TEN                                    BINPU182
00206  0767 00 0 00014          ALS     12                                     BINPU183
00207 -0501 00 0 77777          ORA     COMMON          RIGHT ADJUSTED SEQ NO. BINPU184
00210  0020 00 4 00001          TRA     1,4                                    BINPU185
00211 -0500 00 0 00306  COSEQX  CAL     BLANK           BLANK OUT SEQ. NO.     BINPU186
00212  0020 00 4 00001          TRA     1,4                                    BINPU187
                        *                                                      BINPU188
                        ************************************************************BINPU189
                        *                                                      BINPU190
00213 -0 00030 0 77740  PUNCMD  IOCP    CIMAGE,0,24                            BINPU191
00214  0 00003 0 77730          IOCD    LAST,0,3                               BINPU192
                        *                                                      BINPU193
                        * TABLE FOR BCD ADDITION OF 1 TO C(ACC)                BINPU194
                        *                                                      BINPU195
00215  0000 00 0 00215   TB1    HTR     TB1                 0                  BINPU196
00216  0100 00 0 00215   TB     TZE     TB1                 1                  BINPU197
00217  0200 00 0 00215          MPY     TB1                 2                  BINPU198
00220  0300 00 0 00215          FAD     TB1                 3                  BINPU199
00221  0400 00 0 00215          ADD     TB1                 4                  BINPU200
00222  0500 00 0 00215          CLA     TB1                 5                  BINPU201
00223  0600 00 0 00215          STZ     TB1                 6                  BINPU202
4
00224  0700 00 0 00215          CPY     TB1                 7                  BINPU203
TD
00225  1 00000 0 00215          TXI     TB1                 8                  BINPU204
00226  1 10000 0 00215          TXI     TB1,0,4096          9                  BINPU205
00227  0000 00 0 00216          HTR     TB                  0 WITH CARRY       BINPU206
                        * TABLES FOR BCD-COL. BIN. CONVERSION                  BINPU207
                        * HOLES ARE FILLED IN WITH CONSTANTS                   BINPU208
00230 +000000001000      TAB    OCT     1000,400,200,100,40,20,10,4,2,1        BINPU209
00231 +000000000400
00232 +000000000200
00233 +000000000100
00234 +000000000040
00235 +000000000020
00236 +000000000010
00237 +000000000004
00240 +000000000002
00241 +000000000001
00242 -377777770000      MSK2CH OCT     777777770000,102,42                    BINPU210
```

```
00243 +000000000102
00244 +000000000042
00245 +000000000000      ID123 OCT     0,0,0                                                          BINPU211
00246 +000000000000
00247 +000000000000
00250 +000000004000            OCT     4000,4400,4200,4100,4040,4020,4010,4004,4002,4001              BINPU212
00251 +000000004400
00252 +000000004200
00253 +000000004100
00254 +000000004040
00255 +000000004020
00256 +000000004010
00257 +000000004004
00260 +000000004002
00261 +000000004001
00262  106060606060      BCI8  BCI     1,8                                                            BINPU213
00263 +000000004102            OCT     4102,4042                                                      BINPU214
00264 +000000004042
00265 -3 77777 7 00000   MSKPDT TXL     0,7,-1                                                         BINPU215
A 00266  0400 00 0 00000  REL   ADD                                                                   BINPU216
00267  606060606060      SEQNO BCI     1,                                                             BINPU217
00270 +000000002000            OCT     2000,2400,2200,2100,2040,2020,2010,2004,2002,2001              BINPU218
00271 +000000002400
00272 +000000002200
00273 +000000002100
00274 +000000002040
00275 +000000002020
00276 +000000002010
00277 +000000002004
00300 +000000002002
00301 +000000002001
00302  0 00000 0 00000   BLSEQ                                                                        BINPU219
00303 +000000002102            OCT     2102,2042                                                      BINPU220
00304 +000000002042
00305  606060606060      BCDID BCI     1,                                                             BINPU221
00306  606060606060      BLANK BCI     1,                                                             BINPU222
00307  0074 00 0 00000   MSKTSX TSX     ,0                                                            BINPU223
00310 +000000000000            OCT     0,1400,1200,1100,1040,1020,1010,1004,1002,1001                 BINPU224
```

```
00311 +000000001400
00312 +000000001200
00313 +000000001100
00314 +000000001040
00315 +000000001020
00316 +000000001010
00317 +000000001004
00320 +000000001002
00321 +000000001001
00322 +000500000000       ZWC    OCT      000500000000        ZERO WORDS FOR TCD                  BINPU225
00323 +000000001102              OCT      1102,1042                                                BINPU226
00324 +000000001042
00325  0 00001 0 00000     D1              0,0,1                                                    BINPU227
00326  0 00000 0 00000   IDLCD  PZE                                                                BINPU228
00327  0 00000 0 00001   L(1)   PZE      1                                                         BINPU229
00330  0 00000 0 00005   5A     PZE      5                                                         BINPU230
00331  0 00014 0 00020    14D   PZE 16,,12                                                        BINPU231
00332 +000000000012      TEN    DEC      10                                                        BINPU232
00333  0000 00 0 00026    A22   HTR      22                                                        BINPU233
00334 +000526000000       IMAGE OCT      000526000000        CONTROL WORD SKELETON               BINPU234
                  77777  COMMON EQU      -1                                                        BINPU235
                  77740  CIMAGE EQU      -32                                                       BINPU236
                  77730  LAST   EQU      -40                                                       BINPU237
                  77776   END   SYN      COMMON-1                                                  BINPU238
                                END                                                                BINPU239
```

BINPU ROUTINE TO WRITE COL BIN CARDS ON TAPE. FIBII 10/11/62
POST PROCESSOR ASSEMBLY DATA

335 IS THE FIRST LOCATION NOT USED BY THIS PROGRAM

REFERENCES TO DEFINED SYMBOLS

330	5A	
325	D1	16
54	G2	34
51	G3	37
31	G4	53
53	G5	50, 52
70	IN	161, 167
216	TB	227
142	X1	6
143	X2	7
144	X4	54
331	14D	11, 122
333	A22	147
105	ABC	115, 117
77776	END	15, 55, 136, 160, 335
160	OUT	66
266	REL	24
120	SV1	102
230	TAB	107
215	TB1	134, 215, 216, 217, 220, 221, 222, 223, 224, 225, 226
332	TEN	176, 201, 205
322	ZWC	155
262	BCI8	36
73	EDIT	157
77730	LAST	113, 214, 335
66	LOCN	17
327	L(1)	74, 133
57	NEXT	151
152	TRCD	56
62	ARRAY	13, 67
305	BCDID	51, 76
6	BINPU	
306	BLANK	211

POST PROCESSOR ASSEMBLY DATA

302	BLSEQ	30, 40, 173
131	BPTES	140
172	COSEQ	45
61	COUNT	20, 70
245	ID123	
326	IDLCD	100, 116
334	IMAGE	25
267	SEQNO	47, 73, 132, 135
146	SWTCH	137
121	WRITE	
0	(IOS)	123
2	(RCH)	126
5	(TES)	141
4	(WER)	131
1	(WRS)	124
3	(WTC)	130
77740	CIMAGE	26, 63, 64, 71, 72, 146, 150, 153, 156, 164, 165, 170, 213, 335
77777	COMMON	162, 166, 177, 203, 207, 335
211	COSEQX	174
242	MSK2CH	
265	MSKPDT	32
307	MSKTSX	33
213	PUNCMD	125
122	WRITE1	

NO ERROR IN ABOVE ASSEMBLY.

BEGIN COMPILATION 14.516

```
C   MATRIX COLUMN BINARY PUNCH SUBROUTINE                                    MPUNCH01
C   CALLING SEQUENCE.....                                                   MPUNCH02
C     CALL MPUNCH (A,M,N,IOUT,ITRA,IORG,BCDZ,MAXM,NTAPE  )                  MPUNCH03
C                                                                           MPUNCH04
C             A = MATRIX TO BE PUNCHED      IORG = ORIGIN OF FIRST CARD     MPUNCH05
C             M = NUMBER OF ROWS            BCDZ = BCD IDENTIFICATION WRD   MPUNCH06
C             N = NUMBER OF COLUMNS         MAXM = DIMENSIONED NUMBER OF    MPUNCH07
C             IOUT = 0, PUNCH BY COLUMNS                              ROWS  MPUNCH08
C                  = 1, PUNCH BY ROWS      NTAPE= OUTPUT PUNCH TAPE         MPUNCH09
C             ITRA = 0, TRA CARD AFTER WHOLE MATRIX                         MPUNCH10
C                  = 1, TRA CARD AFTER EACH ROW OR COLUMN                   MPUNCH11
                                                                            MPUNCH12
      SUBROUTINE  MPUNCH  (A, M, N, IOUT, ITRA, IORG, BCDZ, MAXM, NTAPE)    MPUNCH13
*     LIST8                                                                 MPUNCH14
      DIMENSION   A(1), T(22)                                               MPUNCH15
                                                                            MPUNCH16
      IS = 0                                                                MPUNCH17
      MN = MAXM*N                                                           MPUNCH18
      IF  ( IOUT )   8,2,8                                                  MPUNCH19
                                                                            MPUNCH20
                                                                            MPUNCH21
C PUNCH BY COLUMNS                                                          MPUNCH22
                                                                            MPUNCH23
    2 J = 1                                                                 MPUNCH24
      J1= IORG                                                              MPUNCH25
      DO  5  I=1,N                                                          MPUNCH26
      CALL BINPU  (A(J), M, J1, BCDZ, IS, NTAPE )                           MPUNCH27
      J = J+MAXM                                                            MPUNCH28
      IS= IS+1+M/22                                                         MPUNCH29
      IF  ( ITRA )  3,4,3                                                   MPUNCH30
                                                                            MPUNCH31
C PUNCH TRA CARD AFTER EACH COLUMN                                          MPUNCH32
                                                                            MPUNCH33
    3 CALL BINPU  (A, 0, 0, BCDZ, IS, NTAPE )                               MPUNCH34
      IS=IS+1                                                               MPUNCH35
      GOTO   5                                                              MPUNCH36
                                                                            MPUNCH37
    4 J1=J1+M                                                               MPUNCH38
```

```
     5 CONTINUE                                                          MPUNCH39
                                                                         MPUNCH40
       IF  ( ITRA )  16,6,16                                             MPUNCH41
                                                                         MPUNCH42
C PUNCH TRA CARD AFTER WHOLE MATRIX                                      MPUNCH43
                                                                         MPUNCH44
     6 CALL BINPU  (A, 0, 0, BCDZ, IS, NTAPE)                            MPUNCH45
       GOTO  16                                                          MPUNCH46
                                                                         MPUNCH47
                                                                         MPUNCH48
C PUNCH MATRIX BY ROWS.                                                  MPUNCH49
     8 J=0                                                               MPUNCH50
       J1=IORG                                                           MPUNCH51
       DO  14  I=1,M                                                     MPUNCH52
       DO  10  K=I,MN,MAXM                                               MPUNCH53
         J=J+1                                                           MPUNCH54
         T(J)=A(K)                                                       MPUNCH55
         IF (J-22 )  10,9,9                                              MPUNCH56
     9 CALL BINPU  (T,22,J1,BCDZ,IS,NTAPE)                               MPUNCH57
       J1=J1+22                                                          MPUNCH60
       IS=IS+1                                                           MPUNCH61
       J=0                                                               MPUNCH62
    10 CONTINUE                                                          MPUNCH63
                                                                         MPUNCH64
       IF  ( J )  12,12,11                                               MPUNCH65
    11 CALL BINPU  (T,J,J1,BCDZ,IS,NTAPE )                               MPUNCH66
       J1=J1+J                                                           MPUNCH67
       IS=IS+1                                                           MPUNCH68
    12 IF ( ITRA )  13,14,13                                             MPUNCH69
                                                                         MPUNCH70
C PUNCH TRA CARD AFTER EVERY ROW                                         MPUNCH71
    13 CALL BINPU  (T,0,0,BCDZ,IS,NTAPE )                                MPUNCH72
       IS=IS+1                                                           MPUNCH73
       J1=IORG                                                           MPUNCH74
    14 J=0                                                               MPUNCH75
                                                                         MPUNCH76
C OR AFTER ENTIRE MATRIX                                                 MPUNCH77
       IF  ( ITRA )  16,15,16                                            MPUNCH78
```

```
      15 CALL BINPU  (A,0,0,BCDZ,IS,NTAPE)                    MPUNCH79
      16 RETURN                                               MPUNCH80
         END(1,1,0,0,0,0,0,1,0,1,0,0,0,0,0)                   MPUNCH81
                                                              MPUNCH82
```

STORAGE NOT USED BY PROGRAM

DEC	OCT	DEC	OCT
279	00427	32561	77461

STORAGE LOCATIONS FOR VARIABLES APPEARING IN DIMENSION AND EQUIVALENCE STATEMENTS

	DEC	OCT	DEC	OCT	DEC	OCT	DEC	OCT
T	278	00426						

STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN COMMON, DIMENSION, OR EQUIVALENCE STATEMENTS

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
I	256	00400	IS	255	00377	J1	254	00376	J	253	00375
MN	252	00374									

LOCATIONS FOR OTHER SYMBOLS NOT APPEARING IN SOURCE PROGRAM

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
1)	249	00371	2)	238	00356	6)	241	00361	9)	247	00367
C)GO	251	00373	E)4	114	00162	E)6	120	00170	E)H	215	00327

LOCATIONS OF NAMES IN TRANSFER VECTOR

	DEC	OCT	DEC	OCT	DEC	OCT	DEC	OCT
BINPU	0	00000						

ENTRY POINTS TO SUBROUTINES NOT OUTPUT FROM LIBRARY

BINPU

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC	EFN	IFN	LOC
2	7	00105	3	15	00147	4	19	00163	5	20	00166
6	22	00175	8	25	00205	9	32	00241	10	37	00263
11	39	00271	12	43	00310	13	44	00312	14	48	00330
15	50	00343	16	52	00352						

```
00000 +223145476460 00   BINPU  BCD  1BINPU
00001 +000000000000 00   $      PZE
00002 +000000000000 00          PZE
00003 +000000000000 00          PZE
00004 -044764452330 00          BCD  1MPUNCH
00005 -063400100001 010         SXD  $,1
00006 -063400200002 010         SXD  $+1,2
00007 -063400400003 010         SXD  $+2,4
00010 +050000400001 00          CLA  1,4
00011 +062100000344 010         STA  1A+171
00012 +040000000367 010         ADD  9)
00013 +062100000232 010         STA  1A+97
00014 +040000000370 010         ADD  9)+1
00015 +062100000176 010         STA  1A+69
00016 +062100000150 010         STA  1A+47
00017 +062100000121 010         STA  1A+24
00020 +040000000367 010         ADD  9)
00021 +062100000115 010         STA  1A+20
00022 +050000400002 00          CLA  2,4
00023 +062100000214 010         STA  1A+83
00024 +062100000164 010         STA  1A+59
00025 +062100000133 010         STA  1A+34
00026 +062100000122 010         STA  1A+25
00027 +050000400003 00          CLA  3,4
00030 +062100000113 010         STA  1A+18
00031 +062100000076 010         STA  1A+5
00032 +050000400004 00          CLA  4,4
00033 +062100000101 010         STA  1A+8
00034 +050000400005 00          CLA  5,4
00035 +062100000337 010         STA  1A+166
00036 +062100000310 010         STA  1A+143
00037 +062100000171 010         STA  1A+64
00040 +062100000145 010         STA  1A+44
00041 +050000400006 00          CLA  6,4
00042 +062100000324 010         STA  1A+155
00043 +062100000211 010         STA  1A+80
00044 +062100000110 010         STA  1A+15
00045 +050000400007 00          CLA  7,4
00046 +062100000347 010         STA  1A+174
00047 +062100000316 010         STA  1A+149
00050 +062100000275 010         STA  1A+132
00051 +062100000246 010         STA  1A+109
00052 +062100000201 010         STA  1A+72
00053 +062100000153 010         STA  1A+50
00054 +062100000124 010         STA  1A+27
00055 +050000400010 00          CLA  8,4
00056 +062100000223 010         STA  1A+90
00057 +062100000130 010         STA  1A+31
00060 +062100000075 010         STA  1A+4
00061 +050000400011 00          CLA  9,4
00062 +062100000351 010         STA  1A+176
00063 +062100000320 010         STA  1A+151
00064 +062100000277 010         STA  1A+134
00065 +062100000250 010         STA  1A+111
00066 +062100000203 010         STA  1A+74
00067 +062100000155 010         STA  1A+52
00070 +062100000126 010         STA  1A+29
00071 +050000000002 00   1A     CLA  2
00072 +060100000366 010         STO  6)+5
00073 +050000000356 010  4A     CLA  2)
00074 +060100000377 010         STO  IS
00075 +056000000000 00   5A     LDQ  MAXM
00076 +020000000000 00          MPY  N
00077 +076700000021 00          ALS  17
00100 +060100000374 010         STO  MN
00101 +050000000000 00   6A     CLA  IOUT
00102 +010000000105 010  6A1    TZE  7A
00103 +012000000205 010         TPL  25A
00104 +002000000205 010         TRA  25A
00105 +050000000357 010  7A     CLA  2)+1
00106 +060100000375 010         STO  J
00107 -053400100375 010         LXD  J,1
00110 +050000000000 00   8A     CLA  IORG
00111 +060100000376 010         STO  J1
00112 -053400200357 010  9A     LXD  2)+1,2
00113 +050000000000 00          CLA  N
```

```
00114 +062200000167 010        STD 20A2
00115 +075400100000 00  10A    PXA A+1,1
00116 +040200000115 010        SUB *-1
00117 +062100000121 010        STA 11A+1
00120 +007400400000 010 11A    TSX BINPU,4
00121 +007400000000 00         TSX A
00122 +007400000000 00         TSX M
00123 +007400000376 010        TSX J1
00124 +007400000000 00         TSX BCDZ
00125 +007400000377 010        TSX IS
00126 +007400000000 00         TSX NTAPE
00127 +050000000375 010 12A    CLA J
00130 +040000000000 00         ADD MAXM
00131 +060100000375 010        STO J
00132 -053400100375 010        LXD J,1
00133 +050000000000 00  13A    CLA M
00134 +076500000043 00         LRS 35
00135 +022100000360 010        DVP 2)+2
00136 +076000000000 00         CLM
00137 +076300000022 00         LLS 18
00140 -060000000372 010        STQ 1)+1
00141 +050000000377 010        CLA IS
00142 +040000000357 010        ADD 2)+1
00143 +040000000372 010        ADD 1)+1
00144 +060100000377 010        STO IS
00145 +050000000000 00  14A    CLA ITRA
00146 +010000000162 010 14A1   TZE E)4
                        15A    BSS
00147 +007400400000 010 16A    TSX BINPU,4
00150 +007400000000 00         TSX A
00151 +007400000356 010        TSX 2)
00152 +007400000356 010        TSX 2)
00153 +007400000000 00         TSX BCDZ
00154 +007400000377 010        TSX IS
00155 +007400000000 00         TSX NTAPE
00156 +050000000377 010 17A    CLA IS
00157 +040000000357 010        ADD 2)+1
00160 +060100000377 010        STO IS
00161 +002000000166 010 18A    TRA 20A
00162 -063400100373 010 E)4    SXD C)GO,1
00163 +050000000376 010 19A    CLA J1
00164 +040000000000 00         ADD M
00165 +060100000376 010        STO J1
                        20A    BSS
00166 +100001200167 010 20A1   TXI *+1,2,1
00167 -300000200115 010 20A2   TXL 10A,2
00170 -063400100373 010 E)6    SXD C)GO,1
00171 +050000000000 00  21A    CLA ITRA
00172 +010000000175 010 21A1   TZE 22A
00173 +012000000352 010        TPL 52A
00174 +002000000352 010        TRA 52A
                        22A    BSS
00175 +007400400000 010 23A    TSX BINPU,4
00176 +007400000000 00         TSX A
00177 +007400000356 010        TSX 2)
00200 +007400000356 010        TSX 2)
00201 +007400000000 00         TSX BCDZ
00202 +007400000377 010        TSX IS
00203 +007400000000 00         TSX NTAPE
00204 +002000000352 010 24A    TRA 52A
00205 +050000000356 010 25A    CLA 2)
00206 +060100000375 010        STO J
00207 -053400100375 010        LXD J,1
00210 -063400100373 010        SXD C)GO,1
00211 +050000000000 00  26A    CLA IORG
00212 +060100000376 010        STO J1
00213 -053400200357 010 27A    LXD 2)+1,2
00214 +050000000000 00         CLA M
00215 +062200000336 010        STD 48A2
00216 -075400200000 00         PXD 0,2
00217 +060100000400 010        STO I
00220 -053400400400 010 28A    LXD I,4
00221 +050000000374 010        CLA MN
00222 +062200000264 010        STD 37A2
00223 +050000000000 00         CLA MAXM
00224 +062200000263 010        STD 37A1
```

```
00225 +050000000375 010 29A     CLA J
00226 +040000000357 010         ADD 2)+1
00227 +060100000375 010         STO J
00230 -053400100375 010         LXD J,1
00231 -063400100373 010         SXD C)GO,1
00232 +050000400000 00  30A     CLA A+1,4
00233 +060100100427 011         STO T+1,1
00234 +050000000375 010 31A     CLA J
00235 +040200000360 010         SUB 2)+2
00236 +010000000241 010 31A1    TZE 32A
00237 +012000000241 010         TPL 32A
00240 +002000000263 010         TRA 37A
00241 -063400400365 010 32A     SXD 6)+4,4
00242 +007400400000 010 33A     TSX BINPU,4
00243 +007400000426 010         TSX T
00244 +007400000360 010         TSX 2)+2
00245 +007400000376 010         TSX J1
00246 +007400000000 00          TSX BCDZ
00247 +007400000377 010         TSX IS
00250 +007400000000 00          TSX NTAPE
00251 -053400400365 010         LXD 6)+4,4
00252 +050000000376 010 34A     CLA J1
00253 +040000000360 010         ADD 2)+2
00254 +060100000376 010         STO J1
00255 +050000000377 010 35A     CLA IS
00256 +040000000357 010         ADD 2)+1
00257 +060100000377 010         STO IS
00260 +050000000356 010 36A     CLA 2)
00261 +060100000375 010         STO J
00262 -053400100375 010         LXD J,1
                        37A     BSS
00263 +100000400264 010 37A1    TXI *+1,4
00264 -300000400225 010 37A2    TXL 29A,4
00265 +050000000375 010 38A     CLA J
00266 +010000000310 010 38A1    TZE 43A
00267 +012000000271 010         TPL 39A
00270 +002000000310 010         TRA 43A
                        39A     BSS
00271 +007400400000 010 40A     TSX BINPU,4
00272 +007400000426 010         TSX T
00273 +007400000375 010         TSX J
00274 +007400000376 010         TSX J1
00275 +007400000000 00          TSX BCDZ
00276 +007400000377 010         TSX IS
00277 +007400000000 00          TSX NTAPE
00300 -053400100375 010         LXD J,1
00301 -063400100373 010         SXD C)GO,1
00302 +050000000376 010 41A     CLA J1
00303 +040000000375 010         ADD J
00304 +060100000376 010         STO J1
00305 +050000000377 010 42A     CLA IS
00306 +040000000357 010         ADD 2)+1
00307 +060100000377 010         STO IS
00310 +050000000000 00  43A     CLA ITRA
00311 +010000000327 010 43A1    TZE E)H
                        44A     BSS
00312 +007400400000 010 45A     TSX BINPU,4
00313 +007400000426 010         TSX T
00314 +007400000356 010         TSX 2)
00315 +007400000356 010         TSX 2)
00316 +007400000000 00          TSX BCDZ
00317 +007400000377 010         TSX IS
00320 +007400000000 00          TSX NTAPE
00321 +050000000377 010 46A     CLA IS
00322 +040000000357 010         ADD 2)+1
00323 +060100000377 010         STO IS
00324 +050000000000 00  47A     CLA IORG
00325 +060100000376 010         STO J1
00326 +002000000330 010         TRA 48A
00327 -063400100373 010 E)H     SXD C)GO,1
00330 +050000000356 010 48A     CLA 2)
00331 +060100000375 010         STO J
00332 -053400100375 010         LXD J,1
00333 -063400100373 010         SXD C)GO,1
00334 +100001200335 010 48A1    TXI *+1,2,1
00335 -063400200400 010         SXD I,2
```

```
00336 -300000200220 010 48A2   TXL 28A,2
00337 +050000000000 00  49A    CLA ITRA
00340 +010000000343 010 49A1   TZE 50A
00341 +012000000352 010        TPL 52A
00342 +002000000352 010        TRA 52A
                           50A BSS
00343 +007400400000 010 51A    TSX BINPU,4
00344 +007400000000 00         TSX A
00345 +007400000356 010        TSX 2)
00346 +007400000356 010        TSX 2)
00347 +007400000000 00         TSX BCDZ
00350 +007400000377 010        TSX IS
00351 +007400000000 00         TSX NTAPE
00352 -053400100001 010 52A    LXD $,1
00353 -053400200002 010        LXD $+1,2
00354 -053400400003 010        LXD $+2,4
00355 +002000400012 00         TRA 10,4
00356 +000000000000 00  2)     OCT +000000000000
00357 +000001000000 00         OCT +000001000000
00360 +000026000000 00         OCT +000026000000
00361 +233000000000 00  6)     OCT +233000000000
00362 +000000377777 00         OCT +000000377777
00363 +000000000000 00         OCT +000000000000
00364 +000001000000 00         OCT +000001000000
00365 +000000000000 00         OCT +000000000000
00366 +000000000000 00         OCT +000000000000
00367 +000000000001 00  9)     OCT +000000000001
00370 -000000000001 00         OCT -000000000001
```

ENTRY POINTS TO SUBROUTINES REQUESTED FROM LIBRARY,
(FPT) (TSHM) (RTN) (RWT) (STHM) (FIL) (EFT) (IOS) (WRS)
(RCH) (WTC) (WER) (TES)

MACHINE TAPE	TOTAL WRITES	TOTAL READS	NOISE RECORDS WRITING	NOISE RECORDS READING	TOTAL REDUNDANCIES WRITING	TOTAL REDUNDANCIES READING	POSITIONING ERRORS
A 1	0	522	0	0	0	0	0
B 2	536	554	0	0	0	0	0
B 3	91	102	0	0	0	0	0
A 4	372	405	0	0	0	0	0
A 2	0	635	0	0	0	0	0
A 3	793	3	0	0	0	0	0
B 4	141	145	0	0	0	0	0

EXECUTION 14.527

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The matrices $[C_{hs}]$, $[C_{hd}]$, and $[C_{hi}]$ are seen to be steady, damping, and inertial AICs, respectively. The oscillatory AICs are defined by

$$\{F\} = \rho\omega^2 b_r^2 s[C_h]\{h\}$$

and are related to the above definitions through

$$2k_r^2(\bar{c}s/S)[C_h] = [C_{hs}] + ik_r(\bar{c}/b_r)[C_{hd}] - k_r^2(\bar{c}/b_r)^2[C_{hi}] .$$

The Aerospace IBM 7090 Computer Program No. HM15 provides the AICs in printed and optional punched-card output formats. The program capacity is 50 control points and, in the oscillatory case, 50 values of reduced velocity.

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